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THE EVOLUTION OF THE MIND.

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THE mind, in the sense in which I shall here use the word, is the collective function of the sensorium or brain of man and animals. It is the sum total of all psychic changes, actions, and reactions. Under the head of psychic functions are included all operations of the nervous system, as well as operations of like nature which take place in creatures without specialized nerve fibers or nerve cells.

As thus defined, mental operations are not necessarily or exclusively conscious. With the lower animals nearly all of them are automatic and unconscious. Even with man, most of them must be so. But between the automatic and the conscious actions no sharp line of division exists. All functions of the nervous system are alike in nature, and from the present point of view may be considered together. Consciousness is not an entity, but a condition. It stands related to mind much as flame is related to fire.

It is a recognized law in biology that "function precedes structure." To define this law more exactly, we should say that function precedes the differentiation of the organ on which it depends. There is a certain work to be done, and a certain body of cells are set apart sooner or later to do it. Just as plowing was done in some fashion before the invention of the plow, so in some manner respiration was accomplished before the development of gills and lungs. Something of mental action came before there was ever an organized brain.

In the animals of one cell, or protozoa, breathing and digestion are each performed by the whole body. In the division of labor or

specialization which arises in the higher or many-celled animals, certain alliances of cells or tissues are set apart for respiration alone, and certain others for digestion, while other functions of animal life are relegated to still other cell alliances. Each organ in turn is released from all functions except its own.

Irritability, or the response to external stimulus, is an attribute of all living organisms. In the method and degree of response variations occur. These variations favorable to the division of labor and the adaptation of the animal to its surroundings are seized and fixed by natural selection. In this way, on the basis of a diffused function, an organ is built up and the organ itself is specialized and perfected.

The mind and consciousness of man grow out from the irritability of the lower animals. They are developed through series of successive differentiations and integrations. All the higher animals are colonies of co-operating and co-ordinated cells. In such colonies of units the functions of sensation, thought, and motion are relegated to series of the most sensitive and most highly organized cells. This alliance of cells is adequate for the work it has to perform. The brain is always adequate for the mind, for the one is the organ, the other the function, and the development of the two must go on together.

The intellect of man can not be regarded as the crowning marvel of the "great riddles of life." A marvel is no greater for its bigness. Life is one continuous marvel, without break or end. The human mind is one of life's manifestations. The marvel appears in great or small psychic powers alike, for the great powers of the many-celled brain are produced by the co-operation and specialization of the small powers of the single cell. Nature knows neither great nor small. "God works finer with his hands than man can see with his eyes." The single cell is far from simple. The egg or germ cell carries within itself the whole machinery as well as the whole mystery of heredity. The simplest organism we know is far more complex than the Constitution of the United States. Its adjustments, checks, and balances are more perfect. It should in its changing relations be compared rather with the great unwritten constitution of civilized society. The laws of society spring from the laws governing the development of the single cell. If we knew the latter "all in all," as Tennyson says of the flower, "we should know what God is and man is."

If we could know all of any life problem to its uttermost detail, we should have the clew to all life.

Among the protozoa, as already stated, all activities are centered in the single cell which forms the animal unit. Each cell is suf-

ficient unto itself. It is independent and free, but it is at the same time unspecialized and ineffective. Its career offers no scope for volition, for a single life unit can not control the elements which surround it. It is the sport of the wind and the wave. But the recognition of self and non-self, which in one form or another is the attribute of all life, is not wanting among the protozoa. Some of them develop this sense to a large degree. It is said that among the rhizopods are those whose appendages or pseudopodia are at once cast off if they come in contact with the appendages of another of the same species. This recognition of self and non-self is not intellect, but it is homologous with the impulses on which in the higher types personality depends.

All sensation has reference to action. If a creature is not to act, it can not feel. Wherever motion exists there is some sensitiveness to external conditions, and this is of the nature of mind. In a compound organism the nature and position of the sensorium or mind center depend on what it has to do, or rather on what were the duties the same structure had to perform in the life of the creature's ancestors.

A plant may be defined as a sessile animal. It is an organic colony of cells, with the power of motion but not that of locomotion. The plant draws its nourishment from inorganic Nature—from air and water. Its life is not conditioned on a search for food, or on the movement of the body as a whole.

The plant searches for food by a movement of the feeding parts alone. In the process of growth, as Darwin has shown, the tips of the branches and roots are in constant motion. This movement is in a spiral squirm. It is only an exaggeration of the same action in the tendrils of the growing vine. The course of the squirming rootlet may be deflected from a regular spiral by the presence of water. The moving branchlets will turn toward the sun. The region of sensation in the plant and the point of growth are identical, because this is the only part that needs to move. The tender tip is the plant's brain. If locomotion were in question, the plant would need to be differently constructed. It would demand the mechanism of the animal. The nerve, brain, and muscle of the plant are all represented by the tender growing cells of the moving tips. The plant is touched by moisture or sunlight. It "thinks" of them, and in so doing the cells that are touched and "think" are turned toward the source of the stimulus. The function of the brain, therefore, in some sense exists in the tree, but there is no need in the tree for a specialized sensorium.

The many-celled animals, from the lowest to the highest, bear in their organization some relation to locomotion. The animal feeds

on living creatures, and these it must pursue if it is to thrive. It is not the sensitive nerve tips which are to move; it is the whole creature. By the division of labor, the whole body of the compound organism can not be given over to sensation. Hence, the development of sense organs different in character, one stimulated by waves of light, another by waves of sound; one sensitive to odor, another to taste; still others to contact, temperature, muscular strain, and pain. These sense organs through their nerve fibers must report to a sensorium, which is distinct from each one of them. And in the process of specialization the sensorium itself is subdivided into higher and lower nerve centers—centers of conscious thought and automatic transfer of impulse into motion. This transfer indicates the real nature of all forms of nerve action. All are processes of transfer of sensation into movement. The sensorium or brain has no knowledge except such as comes to it from the sense organs through the ingoing or sensory nerves. It has no power to act save by its control of the muscles through the outgoing or motor nerves. The mind has no teacher save the senses; no servants save the muscles.

The reflex action, then, is the type of all mental operations. The brain is hidden in darkness, protected from sensation, as also from injury, by a bony box or a padding of flesh. It has no ideas of its own. It can receive no information directly. But the sense organs flood it with impressions of the external world. From the body itself, by similar means, are transmitted impulses to action. Such impulses in all animals and men are transmitted from generation to generation as a part of the legacy of heredity. They are in their nature rather methods than impulses. Movements go along lines of least resistance, and such lines are part of the stock of heredity.

Many of the impressions from environment are received by the lower nerve centers alone, the sympathetic system or the spinal cord. Here they are converted at once into motion without rising into the region of consciousness. Other sensations rise to the brain itself, and are made the basis of voluntary and conscious action. And between the purely automatic actions and those distinctly conscious and voluntary there may be found every possible intermediate grade.

Moreover, a conscious action often repeated becomes in some degree reflex and automatic. By repeated action nerve connections are formed, which have been compared to the automatic switches of the electric-light plant. By these connections an action once become familiar requires no further attention. This fact is known to us as the formation of habit. That which we do to-day voluntarily and even laboriously, the force of habit will cause us to repeat to-morrow easily, involuntarily, and whether we will or not. By the

repetition of conscious actions the character is formed. This formation of personal character by action I have called "the higher heredity," as distinguished from the true heredity which finds its bounds in the content of the germinal cell. By means of habits each creature builds up in some fashion its own life. In such way and to some degree each is "the architect of his own fortunes." In such manner "the vanished yesterdays" are the rulers of to-morrow.

Besides the actual sensations, besides the so-called realities, the brain retains also the sensations which have been, and which are not wholly lost. Memory pictures crowd the mind, mingling with pictures brought in afresh by the senses. The force of suggestion causes the mental states or conditions of one person to repeat themselves in others. Abnormal conditions of the brain itself furnish another series of feelings with which the brain must deal. Moreover, the brain is charged with impulses to action passed on from generation to generation, surviving because they are useful. With all these arises the necessity for choice as a function of the mind. The mind must neglect or suppress all sensations which it can not weave into action. The dog sees nothing that does not belong to its little world. The man in search of mushrooms "tramples down oak trees in his walks." To select the sensations that concern us is the basis of the power of attention. The suppression of undesired action is a function of the will. To find data for choice among the possible motor responses is a function of the intellect. Intellectual persistency is the essence of individual character.

As the conditions of life become more complex, it becomes necessary for action to become more carefully selected. Wisdom is the parent of virtue. Knowing what should be done logically precedes doing it. Good impulses and good intentions do not make actions safe. In the long run, action is tested not by its motives but by its results.

The child, when he comes into the world, has everything to learn. His nervous system is charged with tendencies to reaction and impulses to motion, which have their survivals from ancestral experience. Exact knowledge, by which his own actions can be made exact, must come through his own experience. The experience of others must be expressed in terms of his own before it becomes wisdom. Wisdom, as I have elsewhere said, is knowing what it is best to do next. Virtue is doing it. Doing right becomes habit if it is pursued long enough. It becomes a "second nature," or, we may say, a higher heredity. The formation of a higher heredity of wisdom and virtue, of knowing right and doing right, is the basis of character-building.

The moral character is based on knowing the best, choosing the

best, and doing the best. It can not be built up on imitation. By imitation, suggestion, and conventionality the masses are formed and controlled. To build up a man is a nobler process, demanding materials and methods of a higher order. The growth of man is the assertion of individuality. Only robust men can make history. Others may adorn it, disfigure it, or vulgarize it.

The first relation of the child to external things is expressed in this: What can I do with it? What is its relation to me? The sensation goes over into thought, the thought into action. Thus the impression of the object is built into the little universe of his mind. The object and the action it implies are closely associated. As more objects are apprehended, more complex relations arise, but the primal condition remains—What can I do with it? Sensation, thought, action—this is the natural sequence of each completed mental process. As volition passes over into action, so does science into art, knowledge into power, wisdom into virtue.

It is thus evident that, with an animal as with an army, *locomotion* demands direction. The sensorium is built up as a director of motion. Natural selection causes the survival of those whose senses are adequate for the safe control of movement. The animal which conducts its life processes in insecurity perishes. The existence of an organism is the test of its adequacy. The continued existence of a series of organisms is the ultimate proof of the truth of the senses.

With the lower animals we have automatic obedience to the demand of external conditions. The greater the stress of the environment the more perfect the automatism, for impulses to safe action must always be adequate for the duty which in the ancestral past they have had to perform. To automatic mind processes inherited from generation to generation the name instinct has been given. Whether instinct is in any degree "inherited habit" or whether it is the product simply of natural selection acting upon the varying methods of automatic response destroying those whose responses are inadequate, need not concern us now.

The homing instinct of the fur seal, concluding its long swim of three thousand miles by a return on a little island hidden in the arctic fogs, to the very spot from which it was driven by the ice six months before, excites our astonishment. But this power is not an illustration of animal intelligence. The homing instinct with the fur seal is a simple necessity of life. Without it the individual would be lost to its species. Only those which have the instinct in perfection can return; only those who return can leave descendants. As to the others, the rough sea tells no tales. We know that not all of the fur seals who set forth return. To those who do return the homing instinct has proved adequate. And this it must always be, so long

as the race exists, for general inadequacy would mean extinction of the species.

The intellect, as distinguished from lower mental operations, is the choice among responses to external conditions. Complex conditions permit a variety of responses. Varying conditions demand a change of response. This demand is met by the intellect. The intellect rises with a complex or changing environment. The greater the stress on a race of thinking creatures, the more active and effective their thoughts. The growth of man has been a succession of triumphs over hard conditions. The races which have been successful have arisen from adversity. Prosperity has been the conquest of hard times. Human progress in general has come through the falling away of the ineffective. The "fool-killer" has been its most active agent. "The goodness and the severity of God" are in science one and the same thing, as they were in the thought of the prophet. Its essence is the survival of those who can live and act effectively and happily in the conditions which surround human and animal life. The power of safe and accurate response to external conditions is the essential feature of sanity. The inability to adapt action to need is a character of insanity. Insanity, except as protected by human altruism, means death.

The difference between intellect and instinct in lower animals may be illustrated by the conduct of certain monkeys brought into relation with new experiences. At one time I had two adult monkeys, "Bob" and "Jocko," belonging to the genus *Macacus*. Neither of these possessed the egg-eating instinct. At the same time I had a baby monkey, "Mono," of the genus *Cercopithecus*. Mono had never seen an egg, but his inherited impulses bore a direct relation to feeding on eggs, as the heredity of *Macacus* taught the others how to crack nuts or to peel fruit.

To each of these monkeys I gave an egg, the first that any of them had ever seen.

The baby monkey, Mono, being of an egg-eating race, devoured his eggs by the operation of instinct. On being given the egg for the first time, he cracked it against his upper teeth, making a hole in it, sucked out all the substance, then, holding the eggshell up to the light and seeing that there was no longer anything in it, he threw it away. All this he did mechanically, automatically, and it was just as well done with the first egg he ever saw as with any other he ate. All eggs since offered him he has treated in the same way.

The monkey Bob took the egg for some kind of nut. He broke it against his upper teeth and tried to pull off the shell, when the inside ran out and fell on the ground. He looked at it for a moment in bewilderment, and then took both hands and scooped up the yolk

and the sand with which it was mixed, and swallowed it all, and then stuffed the shell itself into his mouth. This act was not instinctive. It was the work of pure reason. Evidently his race was not familiar with the use of eggs. Reason is an inefficient agent at first, a weak tool; but when it is trained it becomes an agent more valuable and more powerful than any instinct.

The monkey Jocko tried to eat the egg offered him in much the same way that Bob did, but, not liking the taste, he threw the whole thing away.

The low intelligence of the lower animals—as the fishes—may be at times worse than none at all. If mental development were a real advantage to fishes it would take place through natural selection. The fishes taken in a large pound net, as I have observed them in Lake Michigan, can not escape from it because they have not intelligence enough to find the opening through which they have entered. If, however, a loon enters the net, the fishes become frightened and "lose their heads." In this case they will sooner or later all escape, for they cease to hunt about ineffectively for an opening, but flee automatically in straight lines, and these straight lines will in time bring them to the open door of the net.

Wild animals learn to avoid poisonous plants by instinct. Those who have not an inherited dislike for these plants perish. When the animals are brought into contact with vegetation unknown to their ancestors, this instinct fails them. Hence arises in California the danger from "loco weeds," as certain species of wild vetches are called. These plants produce temporary or permanent insanity or paralysis of nerve centers. The native ponies avoid them, but imported animals do not, and often fall victims to their nerve-poisoning influence.

The confusion of highly perfected instinct with intellect is very common in popular science. The instinct grows weak and less accurate in its automatic obedience as the intellect becomes available in its place. Both intellect and instinct are outgrowths from the simple reflex response to external conditions. But the instinct insures a single definite response to the corresponding stimulus. The intellect has a choice of responses. In its lower stages it is vacillating and ineffective; but as its development goes on it becomes alert, and adequate to the varied conditions of life. It rises with the need for improvement. It will therefore become impossible for the complexity of life to outgrow the adequacy of man to adapt himself to its conditions.

Many animals currently believed to be of high intelligence are not so. The fur seal, just mentioned, for example, finds its way back from the long swim of two or three thousand miles through a foggy

and stormy sea, and is never too late or too early in his arrival. In like manner the female fur seal goes two hundred miles to her feeding grounds in summer, leaving the pup on the shore. After a week or two she returns to find him within a few rods of the rocks where she had left him. Both mother and young know each other by call and by odor, and neither are ever mistaken though ten thousand other pups and other mothers occupy the same rookery. But this is not intelligence. It is simply instinct, because it has no element of choice in it. Whatever its ancestors were forced to do, the fur seal does to perfection. Its instincts are perfect as clockwork, and the necessities of migration must keep them so. But if brought into new conditions it is dazed and stupid. It has no choice among different lines of action.

The Bering Sea Commission once made an experiment on the possibility of separating the young male fur seals from the old ones in the same band. The method was to drive them through a wooden chute or runway with two valvelike doors at the end. These animals can be driven like sheep, but to sort them in this way is impossible. The most experienced males will beat their noses against a closed door, if they have seen one before them pass through it. That this door had been shut, and another beside it opened, passes their comprehension. They can not choose the new direction. In like manner a male fur seal will watch the killing and skinning of his mates with perfect composure. He will sniff at their blood with languid curiosity. "So long as it is not his own it does not matter." That it may be his own in a minute or two it is beyond his power to foresee.

The study of the development of mind in animals and men gives no support to the mediæval idea of the mind as an entity apart from the organ through which it operates.

The "Clavier theory" of the mind, that the *ego* resides in the brain, playing upon the cells as a musician upon the chords of a piano, finds no warrant in fact. There is no *ego* except that which arises from the co-ordination of the nerve cells. All consciousness is "colonial consciousness," the product of co-operation. It stands related to the action of individual cells much as the content of a poem with the words or letters composing it. Its existence is a phenomenon of co-operation. The *I* in man is the expression of the co-working of the processes and impulses of the brain. The brain is made of individual cells, just as England is made of individual men. To say that England wills a certain deed, or owns a certain territory, or thinks a certain thought, is no more a figure of speech than to say that "I will," "I own," or "I think." The "England" is the expression of union of the individual wills, thoughts, and ownerships of

Englishmen. Similarly, my "*ego*" is the expression of the aggregate force co-ordination of the elements that make up my body.

The old dictum of the philosopher, "I think, therefore I am," is not literally and wholly true. "We think, therefore we are," we co-ordination of brain cells, would be quite as rational. But we brain cells do not think individually, only collectively or colonially, so no single sentence can express the whole truth, nor can a trustworthy philosophy grow out of any axiom of this sort.

The development of the character is the formation of the *ego*. It is in itself the co-ordination of the elements of heredity, the bringing into union of the warring tendencies and irrelevant impulses left us by our ancestors. The child is a mixture of imperfectly related impulses and powers. It is a mosaic of ancestral heredity. Its growth into personality is the process of bringing these elements into relation to each other.

In a remarkable study of the phenomena of "conversion," Mr. Edwin Diller Starbuck gives this view of the physiological phenomena associated with the development of personality, the building up of a *self* by a process which is primarily unselfing": "It is pretty well known," Mr. Starbuck says, "that the quality of mind is much dependent upon the fineness of nervous structure. The child has about as many nerve cells as the adult. They differ from those of the adult in form. Those of the child are mostly round, whereas those of the adult have often very many branches with which they connect with the other cells. Nervous growth seems to consist largely in the formation of new nervous connections. The rapid growth at puberty probably means that at that time there is a great increase in nervous branching. The increased ramification of nervous tissue probably determines the ability for seeing in general terms, for intellectual grasp, and for spiritual insight. The rapid formation of new nerve connections in early adolescence may be the cause of the physiological unrest and mental distress that intensifies into what we have called the sense of incompleteness which precedes conversion. The mind becomes a ferment of half-formed ideas, as the brain is a mesh of poorly organized parts. This creates uncertainty, unhappiness, dejection, and the like, because there is not the power of free mental activity. The person is restless to be born into a larger world that is dimly felt. Finally, through wholesome suggestions or normal development, order comes and the new world dawns. Often some emotional stress or shock strikes harmony into the struggling imperfection, and truth comes like a flash."

The evil effect of the excess of sense impressions and of thought dissociated from will and action has been noted many times and in

many ways. When men have made themselves wise with the lore of others, the learning which ends in self and does not spend itself on action, they have been neither virtuous nor happy. "Much learning is a weariness of the flesh." Thought without action ends in intense fatigue of the soul, the disgust with all "the sorry scheme of things entire," which is the mark of the unwholesome and insane philosophy of pessimism. This philosophy finds its condemnation in the fact that it has never yet been translated into pure and helpful life.

In like manner has sentiment not woven into action failed to be a source of effectiveness or of happiness. "If thou lovest me," said Christ to Simon Peter, then shalt thou "feed my lambs." Genuine love works itself out in self-spending, in doing something for the help or pleasure of those beloved. Religious sentimentalism, whatever form it may take, if dissociated from action, has only evil effects. Appeals to the emotions for emotion's sake have been a great factor in human deterioration. Much that has been called "degeneration" in modern social life is due to the predominance of sensory impressions over motor movement. The mind passes through a round of sensations, emotions called up by literature, music, art, religion, none of these having any direct bearing on human conduct. Their aggregate influence on the idle soul is always an evil one. And the misery of motor paralysis, of intellectual pauperism, is felt as the disease of *ennui*. The remedy for evils of reverie, *ennui*, narcotism, and the like, is to be found in action. The knowledge of this fact constitutes the strength of the Salvation Army movement. The victim of mental deterioration is given something to do. He is not to wear out the little force he has in ineffective remorse. Better let him beat a big drum and make night hideous with unmusical song than to settle down to the dry rot of reverie or the wet rot of emotional regret. Something to do, and the will to act, furnish the remedy for all forms of social discontent.

Not every sense impression needs a distinct response. It is the function of the intellect to sift these impressions, turning over into action only those in which action is desirable or wise. The power of attention is one of the most valuable attributes of the trained mind; and the essential of this power is in the suppression by the will of all impulses which do not concern the present need of action.

As the normal workings of the mind are reducible to sensation, thought, will, and action, so the abnormal workings may be due to defects of any one of these elements. We may have defects of sensation, defects of thought, vacillation of will, and inaccuracy of action. Hyperæsthesia, anæsthesia, sensory weakness, appear in the uncertain action of the muscles guided by the ill-informed brain.

The defects and diseases of the brain itself show themselves in many ways, ranging from oddity or folly to the extreme of idiocy or mania. Most of the "psychic phenomena" along "the border land of spirit," which occupy a large part in current discussions, are characters of insanity. The phenomena of hysteria, faith-cure, openness to suggestion, subjective imagery, mysticism, are not indications of spiritual strength, but of decay and disintegration of the nerves. The ecstasy of unbalanced religious excitement and a stupor of a drunken debauch may belong to the same category of mental phenomena. Both point toward moral and spiritual decay. There are no occult or "latent powers" of the mind except those which have become useless or which belong to the process of disintegration. If a man crosses his eyes, and is thus enabled to see objects double, we do not regard him as having developed a "latent power" of vision. He has simply destroyed the normal co-ordination of such powers. In like manner, one does not increase the strength of a rope by untwisting its many strands. The effectiveness of life depends upon the co-ordination and co-operation of the parts of the nervous system. Its strands must be kept together. To move in a state of reverie, "to live in two worlds at once," to be unable to separate memory pictures from realities, all these are forms of nervous disintegration. Every phase of them can be found in the madhouse. The end of such conditions is death. The healthy mind should combat all tendencies toward disintegration. It can be clean and strong only by being true.

In like manner the influence of all drugs which affect the nervous system must be in the direction of disintegration. The healthy mind stands in clear and normal relations with Nature. It feels pain as pain. It feels action as pleasure. The drug which conceals pain or gives false pleasure when pleasure does not exist, forces a lie upon the nervous system. The drug which disposes to reverie rather than to work, which makes us feel well when we are not well, destroys the sanity of life. All stimulants, narcotics, tonics, which affect the nervous system in whatever way, reduce the truthfulness of sensation, thought, and action. Toward insanity all such influences lead; and their effect, slight though it be, is of the same nature as mania. The man who would see clearly, think truthfully, and act effectively, must avoid them all. Emergency aside, he can not safely force upon his nervous system even the smallest falsehood. And here lies the one great unanswerable argument for total abstinence; not abstinence from alcohol alone, but from all nerve poisons and emotional excesses. The man who would be sane must avoid all nerve excitants, nerve soothers, and "nerve foods," as well as trances, ecstasies, and similar influences. If he would keep his

mind he must never "lose his head" save in the rest of normal sleep.

No great work was ever accomplished under the influence of drugs or stimulants. The great thoughts and great works which have moved the world came from men who have lived pure, sober lives. These were men whose nervous systems were truthful as the stars, and the great truths of the universe they could carry over into action.

What is true of man is true of animals, and true of nations as well; for a nation is an aggregation of many men as a man is a coalition of many cells. In the life of a nation, Lowell tells us, "three roots bear up Dominion—Knowledge, Will, the third Obedience, the great tap-root of all." This corresponds to the nervous sequence in the individual. And as in general the ills of humanity are due to untruthfulness in thought and action, so are the collective ills of nations due to national folly, vacillation, and disobedience. The laws of national greatness are extensions of the laws which govern the growth of the single cell.

SCHOOL GARDENS.

By HENRY LINCOLN CLAPP.

IN cities where Nature study has been introduced, it has become evident that the required number of plants suitable for the purpose of instruction in the elements of botany is obtained often with considerable difficulty. A school in the suburbs, with woods and fields near, and a free range for its pupils, in a few years finds the open places occupied with houses and notices to trespassers, and the sources of material for observation work cut off. In the public parks are posted notices forbidding the plucking of a leaf or the breaking of a twig. There is plant material enough for study everywhere, even in a city, but it is not available for schools.

School grounds are generally given up to play or gymnastic exercises. Only a few educators in this country have thought of them as sources for obtaining plant material for observation work. In many places in Europe school grounds are very much better managed than in this country. Not only do school authorities there aim to supply materials for study in the schoolroom, but they mean to impart clear ideas of horticulture and related occupations by various uses of land connected with the schools. They appreciate the training which results from pruning, budding, and grafting trees, plowing, hoeing, and fertilizing land, hiving bees, and raising silkworms.

In 1890 there were nearly eight thousand school gardens—gardens for practical instruction in rearing trees, vegetables, and fruits—in Austria. The Austrian public-school law reads: "In every school a gymnastic ground, a garden for the teacher, according to the circumstances of the community, and a place for the purposes of agricultural experiment are to be created. School inspectors must see to it that, in the country schools, school gardens shall be provided for corresponding agricultural instruction in all that relates to the soil, and that the teacher shall make himself skillful in such instruction. Instruction in natural history is indispensable to suitably established school gardens. The teachers, then, must be in a condition to conduct them."

In France gardening is practically taught in twenty-eight thousand primary and elementary schools, each of which has a garden attached to it, and is under the care of a master capable of imparting a knowledge of the first principles of horticulture. No one can be appointed master of an elementary school unless qualified to give practical instruction in cultivating the ordinary products of the garden.

In Sweden, as long ago as 1871, twenty-two thousand children received instruction in horticulture and tree planting, and each of two thousand and sixteen schools had for cultivation a piece of land varying from one to twelve acres.

Still more significant is the recent establishment of many school gardens in southern Russia. In one province two hundred and twenty-seven schools out of a total of five hundred and four have school gardens whose whole area is two hundred and eighty-three acres. In 1895 these gardens contained one hundred and eleven thousand fruit trees and two hundred and thirty-eight thousand three hundred planted forest trees. In them the schoolmasters teach tree, vine, grain, garden, silkworm, and bee culture. They are supported by small grants of money from the country and district councils. In the villages, small orchards and kitchen gardens are connected with many primary schools. This movement has also widely spread over different provinces of central Russia.

If the establishment of school gardens in the country is a wise step, the advantages of such gardens in cities should be apparent at once.

Since 1877 every public school in Berlin, Prussia, has been regularly supplied with plants for study every week, elementary schools receiving specimens of four different species and secondary schools six. During the summer, at six o'clock in the morning, two large wagons start from the school gardens, loaded with cuttings packed and labeled for the different schools. The daily papers

regularly announce what plants may be expected, and teachers consult with the gardeners as to what ought to be sown or planted. Teachers take their classes into the school gardens for lessons in botany, and are aided by the gardeners, who cut the specimens.

The gardens in Berlin are few in number, and lack many advantages to be found in the country gardens. Comparatively few pupils can see the plants growing from seed to seed, or growing at all. The butterflies, beetles, and other insects which are constantly

HEPATICA TRILOBA. George Putnam School Garden.

at work on growing plants come to the notice of only a few children, consequently their habits can not be known to many. The nature of annuals and biennials, the growth of plants from week to week, the results of varying conditions of soil, light, heat, and moisture, which are so necessary to a broad and sound understanding of plant growth, can not be properly understood if reliance is to be placed on cut specimens alone. With cut specimens there are cut off more than half of the advantages to be found in the study of plants growing under favorable conditions.

Such considerations lead to the conclusion that every school should have its own garden, where the opening and closing of blossoms, the springing and unclosing crosiers of ferns, the clinging tendrils and rootlets of various vines, and numerous other habits of growth may be observed at the right time.

In March, 1890, a paper entitled Horticultural Education for

Children was read in Boston before the Massachusetts Horticultural Society by one of its members. The interest aroused by the reading of this paper resulted in the establishment of a school garden in connection with one of the Boston grammar schools in the spring of 1891. A committee of the society promised such pecuniary support as seemed to be needed from time to time. Mrs. Henrietta L. T. Wolcott, then at the head of the committee, in presenting the claims of school-garden work to the society, said: "We desire to emphasize the true idea of a school garden. Growing plants, from the first sign of germination to the full perfection of blossom and fruit, and edible roots in all stages, give constant opportunity for study. We believe that by means of the school garden children can be so trained to appreciate plants growing naturally that the present custom of laying out public gardens with flowering and foliage plants arranged in the form of grotesque designs, portraits of distinguished men, symbols of trades, spiritual suggestions or emblems, and rolls of carpeting framed and left out in rain and sunshine will in time disappear. Setting rows of plants in military precision and replacing them by others like magic can have but little educational value."

Since the committee intended to offer premiums for the best school gardens, they thought that persons might be induced to buy the ordinary cultivated plants of a florist, and with them make what they might choose to call school gardens. This, however, would not imply any proper knowledge of such plants, or more useful ones, nor ability to make good use of them as objects for study. It was thought that troubles might arise from allowing a florist's garden to be taken as the standard for the gardens which they wished to see established. The one who spent the most money, or had the most persuasiveness among florists, might establish fine gardens, lay claim to premiums in good faith, and win them; and yet such gardens might not serve the purpose which the committee considered best. Accordingly, they decided that in the beginning only those plants which were the most suitable for educational purposes should form the main stock of the school gardens. The decision was expressed thus: "Ornamental plants, or those commonly cultivated in flower gardens, will not stock the school gardens contemplated by the committee. Native wild plants, such as ferns, grasses, asters, golden-rods, violets, native shrubs, and economic plants, such as grains, vegetable roots, and leguminous and cucurbitaceous plants, must be the stock of the gardens."

Later, when children's natural love for color and the influence of beautiful flowers in the schoolroom in cultivating æsthetic tastes came to be considered, cultivated plants were allowed introduction,

but in a secondary place. It was claimed with truth that teachers who have beautiful flowers on their desks, and fine bits of color on the walls of their rooms, were likely to have other matters in harmony, order, neatness, quietness, and an atmosphere conducive to study. The flowers seem to set the key, and other matters are tuned up to that pitch. Pupils appreciate the conditions and the teacher. Unscholarly conduct is felt to be a discordant note, and the sentiment of the class is against it. However, the committee

ASTER CORDIFOLIUS. George Putnam School Garden.

had other and perhaps higher aims to accomplish. They wished pupils to take a positive, conscious part in the development of plant life.

In accordance with the conditions mentioned, the committee decided to start a garden where the circumstances seemed most favorable, and appropriated ten dollars for the purpose. A piece of ground forty-eight by seventy-two feet in the back of the boys' yard of the George Putnam Grammar School was found the most available, and a few teachers in the school offered all the assistance in their power to carry out the purposes of the committee.

The soil was such as one might expect to find where no thought of plants or plant materials for a moment entered the minds of those

who were instrumental in the establishment of the school and the preparation of the course of study.

The pupils brought in many wild plants, and the fleshy roots of biennials—turnips in variety, carrot, parsnip, radish, beet, onion (bulb), cabbage, etc. In planting, they took turns in digging the holes and placing the plants in position. Observations were made during the flowering season. The structure of the flowers of the cruciferous and umbelliferous plants was studied, and the nature of biennials was revealed. Other economic plants, such as the potato, the tomato, and the gourd, were raised to show the individualism of plants.

A square yard of ground was assigned to each of the ordinary grains—wheat, rye, oats, barley, and buckwheat. The first four, being most important members of the grass family, were especially interesting in their development. After that, grains meant more to the pupils.

Nineteen species of wild asters were planted in one row. Ten of the finest flowering kinds formed another row. Later it was discovered that those plants blossomed the most profusely which sprang from seeds scattered at random around trees and beside rocks and fences.

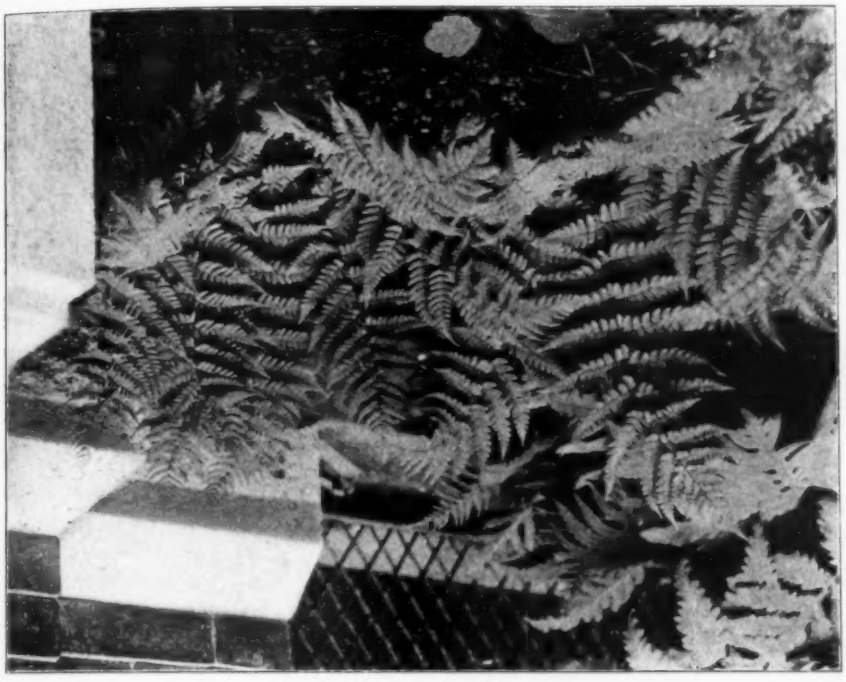
In the fall, seed vessels were collected for study in winter, and bulbs, corms, and tubers were stored away for spring planting.

Each member of the highest class had a particular plant to take care of and study. He dug around and watered it, took off all dead leaves and unseemly branches, and tied it up. Then he sketched its characteristic parts—flower, leaf, stem, habit of growth, etc.—and took such written notes as would enable him to write an account of his plant and illustrate it with appropriate drawings. On one occasion each of the thirty-two members of the class studied his own clump of asters, there being just clumps enough to go around. The importance of seeing and studying plants growing in large masses is not likely to be overestimated if interest and thoroughness in learning about them are desired. Comparatively, a single cut specimen in hand means but little.

By the aid of the boys a fernery was made in an angle of the school building on the north side, in a shady, sheltered position. They took handcarts into the woods half a mile distant and collected leaf-mold, which they mixed up thoroughly with loam and sand, and then assisted in taking the ferns from scattered places in the garden and locating them by genera in the fernery. The name of each species was written on a flat stick, which was stuck into the ground near the specimen to which the name belonged.

Seeing what one teacher had done, another, by means of a

hand camera, made a series of lantern slides, which proved to be of the greatest service for class instruction during the following winter. A solar camera and a twelve-foot screen completed the



A Corner of the Fernery. George Putnam School Garden.

equipment for the most interesting and profitable kind of instruction on the subject of ferns.

The pupils of one class studied fifteen species somewhat minutely by means of the slides and pressed specimens. Spores, sporangia, indusia, sori, pinnules, pinnæ, rachis, stipe, general shapes, textures, and relative position of parts were carefully observed, drawn, described, and colored. Notebooks contained characteristic parts of all the different species, which were broken up and distributed for the purpose. This study prepared the pupils to appreciate the development of fern crosiers in the fernery in the following spring. Twenty-two pupils out of the class of thirty-eight introduced ferns into their own gardens at home.

Other classes studied composite flowers, distribution of seeds, roots, corms, tubers, bulbs, and other material supplied by the garden.

In the spring of 1895 the development of fern crosiers was studied with great interest by the pupils. The collection of lantern slides soon included representations of the crosiers of the principal species in various stages of growth. In some respects the pictures

of the crosiers served a more useful purpose than the crosiers themselves, because their representations on the screen were very large, and could be seen very easily by the whole class at once.

At present there are more than one hundred and fifty different species of native wild plants in the garden. No attempt has been made to arrange them in ornamental beds, since they can not be studied so well in that arrangement. When over fifty pupils at a time are to study growing plants, such plants must be easily accessible, and therefore scattered as much as is consistent with other con-

FOURTH-GRADE PUPILS OBSERVING. George Putnam School Garden.

ditions, especially that of caring for the plants and mowing the grass about them. Three or four times as many children can examine twenty plants set in rows as can examine them arranged in a bed; and the work of weeding the plants and cutting the grass in the former arrangement is not half as much as in the latter. The useful arrangement always takes precedence of the ornamental.

A great many insects have been observed upon the plants—beetles, wasps, flies, moths, and butterflies. In the last class nine species have been seen: *Pieris rapae*, *Colias philodice*, *Melitæa pharos*, *Cynthia Atalanta*, *Grapta interrogationis*, *Cynthia cardui*, *Danais Archippus*, *Papilio turnus*, and *Lycæna americana*. Soon

the garden will afford the pupils their only opportunities for studying, describing, drawing, and painting such insects.

How the garden is supported, and how the necessary work is done, are interesting questions to those who think of starting a garden. Since 1891 the Massachusetts Horticultural Society has offered every year a premium of fifteen dollars for the best school garden, in connection with the best use of it. This garden has competed with others, and won the premium every year. Five dollars pays for the annual enrichment of the soil, and ten dollars for the labor of the janitor, who, during the long summer vacation, weeds, hoes, and waters the plants, and cuts the grass periodically. In spring he wheels in and spreads fertilizing material, prepares new beds or rows, and resets old ones with plants changed from other localities. During the school season in spring and autumn teachers and pupils do considerable work in weeding and transplanting; the former being able to distinguish choice plants, however small, from weeds, which many a so-called good gardener is frequently unable to do.

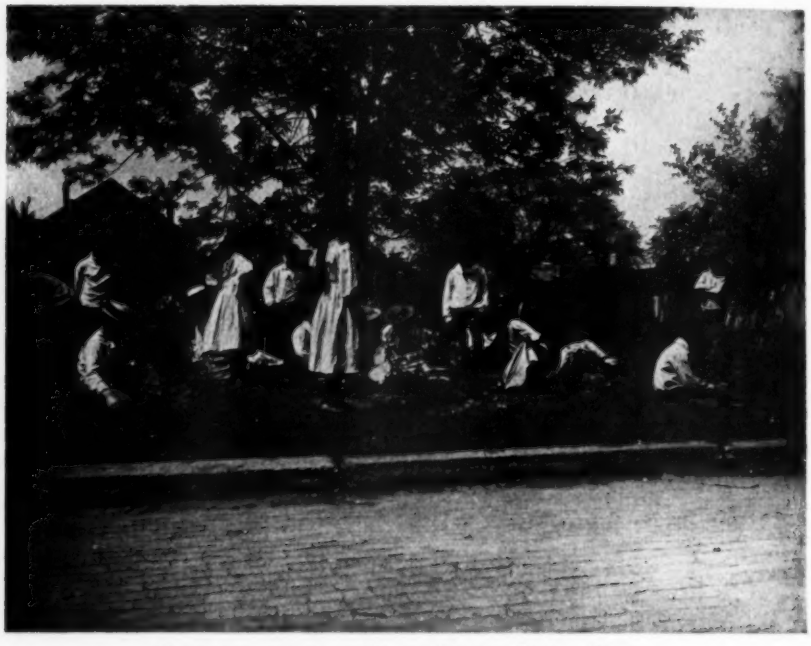
Reasons that are good for introducing the elements of science into elementary schools are equally good for supplying adequate and seasonable elementary science material to work upon. Plants are so available for the purposes of instruction, their structure, uses, and functions are so varied and interesting, that it is generally conceded that the best elementary science material on the whole is found in the vegetable world.

The repulsion that is so often felt in studying animals or animal physiology is unknown in studying plants, and the cycle of plant life from seed to seed furnishes a lesson in biology that is unsurpassed in value. Moreover, living plants, out of doors, are necessarily connected with mineral forms—air, earth, and water—as well as with various forms of animal life—butterflies, moths, beetles, wasps, ants, grubs, and worms—all together furnishing constant illustrations of correlation under the best conditions.

The elements of zoölogy may be studied in the schoolroom with some profit by means of dried and alcoholic specimens, skeletons, diagrams, and books, but visible correlation will of necessity be wholly left out. The same may be said of mineralogy or mineral substances generally. But in the school garden the interdependence of animals, plants, and minerals is always obvious, and teachers and pupils can take advantage of it without taking time and money to go to the country for the purpose of seeing the three kingdoms of Nature properly related. Of course, the excursion is better in many respects, since many instructive things may be seen which are not possible for a school garden; but the excursion at best is seldom practicable. On the school premises, pupils are

much more amenable to control and instruction than on an excursion. Without the school garden the great masses of children in cities will never have their attention directed to the great lessons of Nature in any telling way. Some of them may visit the country, but very few will have efficient direction, and the results will be meager.

It is too much to expect that teachers, especially those in city schools, will unremittingly supply fresh material whenever needed for instruction in the elements of science. Even in the country the



CHILDREN WORKING IN GEORGE PUTNAM SCHOOL GARDEN.

most desirable plants are often far from the school. It would be a most extraordinary school district where fourteen golden-rods, eighteen wild asters, and twenty-nine ferns, all different kinds, might be found growing. Probably half of the plants that would flourish in a school garden could not be found in the district at all; or, if they could, they would be scattered and remote from the school, and whether they were in a proper state of development for study could not always be ascertained easily. The nearness of the school garden is one of its most valuable features.

A book might be written on the educational value of a school garden properly used; but mention of its main advantages must suffice. Besides the opportunity for correlation, previously mentioned, it gives the opportunity for bringing together a great number of plants to be classified and arranged in families, genera, and species.

The reason for such classification becomes apparent in the grouping of plants similar in form, structure, and habits; and the comparison of many such plants impresses on the child's mind the characteristics of families, genera, and species in the most forcible manner. What cultivation will do by way of increasing the vigor of plants and making them blossom and fruit more freely is fully illustrated every season. Pupils learn that they can be instrumental in starting the wonderful development of plants. They learn how Nature provides for the continuance of species by storing up food in seeds, roots, and fruit, and protecting delicate organs by impervious gums, imbricated coverings, and woolly packings. Lessons in human economy are learned from the study of vegetable economy. The mutual dependence of insects and plants is seen to be characteristic of mutual dependence in the world at large.

The school garden affords by far the best means for the cultivation of the powers of observation. Pupils find excellent forms to draw, colors to imitate, habits to describe, and motives to use in decorative design. They find something to take care of, something that quickly responds to love's labor, and as interest is added to interest they lay up for themselves resources for happiness that should be the heritage of every child, even the poorest city child; and this would be so if school authorities and the people behind them had more real insight into children's best natures, more foresight, more humanity, and more liberality in the purchase and equipment of school grounds.

To spend large sums of money on architectural beauties and stone carvings of historic ornaments—which have but little attraction for children—to make a school building look like a palace, and then to leave the school yard looking like a desert or the top of a bituminous lake, without a single attractive flower or one bit of beauty, are inconsistencies which seem possible only in the modern system of education. Weather-beaten houses in the country, log cabins on the frontiers, railroad stations in the "Great American Desert" and all over our country have their beautiful flower gardens, and it refreshes one's soul to see them; but there is no such source of refreshment, inspiration, and instruction where children are being educated in the "essentials."

Once in a while some discerning man, outside of the regular school interests, sees the inconsistency of educational systems, and gives expression to his thoughts on the subject, as Lowell did in his letter to a student, and as Hamilton W. Mabie has done in his Essays on Nature and Culture. Mr. Mabie says: "Relationship with Nature is a resource of inexhaustible delight and enrichment; to establish it ought to be as much a part of every education as the

teaching of the rudiments of formal knowledge; and it ought to be as great a reproach to a man not to be able to read the open pages of the world about him as not to be able to read the open page of the book before him."

If *littérateurs* have reasons to think and talk in that way about existing educational conditions, how should school men, who profess to study school problems and the highest interests of children, be affected by similar conditions—and what should those who appropriate money for school purposes do to establish proper relationship between school children and Nature? The most promising thing would be to establish school gardens, and see that teachers should be in suitable condition educationally to make the best use of them.

The great enrichments in the educational system of Sweden are gymnastics, sloyd, and school gardens. We have adopted the first two, and they have proved to be very helpful in our system of education; now let us adopt the last and best, and line up with France, Austria, and Russia in establishing school gardens as an essential means of educating children properly.

THE UNITED STATES FOREST RESERVES.

By Hon. CHARLES D. WALCOTT,
DIRECTOR, UNITED STATES GEOLOGICAL SURVEY.

HISTORICAL.—The movement in favor of Government forest reserves in the United States began soon after it became apparent that unless some restriction was placed upon the wasteful cutting and destruction of the forests of the continent the timber supply would soon be exhausted. The country would then become dependent upon other nations for its timber supply, and would suffer as do many European states, where great efforts have been made during the last thirty years to restore the forests which had been so wantonly destroyed. One of the most influential agencies in bringing about the establishment of the forest reserves was the agitation carried on by the American Forestry Association and the Division of Forestry of the Department of Agriculture, under the leadership of Dr. B. E. Fernow. The many reports and essays published and lectures delivered had a strong influence in creating a public sentiment that at last manifested itself in the passage, on March 3, 1891, of an act granting authority to the President to set aside as public reservations public lands bearing forests, wholly or in part covered with timber or undergrowth. (Statutes at Large., vol. xxvi, p. 1103, sec. 24.)

Under this act seventeen forest reservations were established prior to September 28, 1893, aggregating in area 17,564,800 acres.

These are: The Pacific Reserve (967,680 acres) of Washington; the Cascade (4,492,800 acres), Bull Run (142,080 acres), and Ashland (18,560 acres) Reserves of Oregon; the Sierra (4,096,000 acres), San Gabriel (555,520 acres), San Bernardino (18,560 acres), and Trabuco Cañon (49,920 acres) Reserves of California; the Yellowstone Park Reserve (1,239,040 acres) of Wyoming; the South Platte (683,520 acres), Plum Creek (179,200 acres), White River (1,198,080 acres), Battlement Mesa (858,240 acres), and Pike's Peak (184,320 acres) Reserves of Colorado; the Grand Cañon (1,851,520 acres) Reserve of Arizona; the Pecos River (311,040 acres) Reserve of New Mexico, and the Afognak Reserve (area unknown) of Alaska.

The establishment of these reserves did not excite any special approval or disapproval of the policy, except as some local interest was affected favorably or unfavorably. In the latter case little attention was paid to it by the parties directly concerned, as there was no real protection of the reserves or public forests by patrol, and the cutting of timber and destruction by fires went on as before. It was not until the executive proclamations of February 22, 1897, were made that great opposition was developed in the Northwestern States, in which many of the reserves were situated. These proclamations, based upon the recommendation of the Forestry Commission of the National Academy of Sciences, established thirteen forest reservations, containing an aggregate area of 21,379,840 acres. Their names, locations, areas, etc., are given in the following table:

Name of Forest Reserve.	Location.	Estimated area (acres).	Object.
Black Hills.....	The central portion of the Black Hills, of South Dakota.	967,680	To protect and make permanently productive this isolated forest, which is essential to adjacent mining and farming interests.
Big Horn.....	Slopes of the Big Horn Mountains in northern central Wyoming.	1,127,680	To protect the water supply of streams important to farming in adjacent regions.
Teton.....	Adjacent to and south of the Yellowstone Park timber reserve.	829,440	To protect the water supply of streams important to farming in adjacent regions.
Flathead.....	Slopes of the Rocky Mountains, Montana, from the Great Northern Railroad to the international boundary.	1,382,400	On the eastern slope to make the forests permanently productive for mining, and to protect the headwaters of tributaries of the Missouri. On the western slope, to protect cultivated valleys from floods.
Lewis and Clark.	Both slopes of the continental divide in Montana, from near the line of the Great Northern Railroad southward nearly to the forty-seventh degree of latitude.	2,926,080	To protect the sources of the Missouri essential to irrigation, to prevent floods, and to preserve the forest for intelligent development of its values.

Name of Forest Reserve.	Location.	Estimated area (acres).	Object.
Priest River.....	Priest Lake and Priest River basin in Idaho and Washington, from the Great Northern Railroad to the international boundary.	645,120	To preserve the timber for future supply and for development of a productive timber reserve.
Bitter Root.....	The Bitter Root Mountains in Montana and Idaho.	4,147,200	To protect the sources of streams important to irrigation in Montana, Idaho, and Washington; to preserve valuable timber and to restore burned forests.
Washington.....	The Cascade Range from south of the forty-eighth parallel to the international boundary, excepting the settled Skagit Valley.	3,594,240	To prevent destruction by fire, to protect the sources of rivers flowing eastward for irrigation, and to render permanent the timber resources of the western slope.
Olympic.....	The Olympic Mountains.	2,188,800	To make a permanent and profitable reserve of the finest body of timber in the United States.
Mount Rainier...	The former Pacific Forest Reserve and an extension southward nearly to the Columbia River along the Cascade Range.	2,234,880	To protect the tributaries of the Yakima requisite for irrigation, and to preserve the forest wealth of the State in this region.
Stanislaus.....	Sierra Nevada in California.	691,200	For protection of water supply for irrigation.
San Jacinto.....	San Jacinto Mountains south of the San Bernardino Reserve.	737,280	For protection of water supply for irrigation.
Uinta.....	Uinta Mountains, exclusive of the Indian reservation.	875,520	For protection of water supply for irrigation and development of the forest for local timber supply.

In the letter recommending the establishment of the reserves, the Forestry Commission stated that it fully recognized the fact that the forest reserves previously established and now proposed can not be maintained unless a plan is adopted under which their boundaries shall be so modified as to take from them all land better suited for agriculture than for the production of forests, and under which their timber can be made available for domestic, mining, and commercial purposes, and valuable minerals can be freely sought and mined within their boundaries. The commission also stated that it believed that the solution of this difficult problem would be made easier if the reserve areas were increased, as the greater the number of people interested in drawing supplies from the reserved territories, or in mining in them, the greater would be the demand on Congress for the enactment of laws securing their proper administration. "For this reason," said the commission, "it is the unanimous opinion of the commission that the establishment by proclamation of the reserves described above is now a matter of the

utmost importance to the development and welfare of the whole country."

The result of establishing the reserves more than met the anticipations of the commission that legislation would follow, owing to the pressure of the people on their representatives in Congress. The first storm of protest came mainly from South Dakota, Wyoming, Montana, and Washington. Public meetings were held at which vigorous speeches were made in opposition to the forest-reserve policy, and soon a flood of petitions and letters reached the senators and representatives from the States mentioned, and those from adjoining States in which reserves are situated or which are dependent upon the reserves for their timber supply. Early in March an amendment was incorporated in the Sundry Civil Bill in the Senate revoking the forest-reserve proclamations of February 22, 1897. This, however, was modified in conference with the House so as to authorize the President to suspend or revoke the proclamations if he thought fit to do so. The bill failed, and when the new Congress assembled, on March 15, the agitation against the reserves was resumed.

A long debate in the Senate was followed by the final passage of an extended amendment providing for the suspension of the reserves established by the proclamations of February 22, 1897, until March 1, 1898, and providing further for the survey of the forest reserves, under the supervision of the Director of the Geological Survey, and appropriating one hundred and fifty thousand dollars for the purpose. Provision was made that " a copy of every topographic map and other maps showing the distribution of the forests, together with such field notes as may be taken relating thereto, shall be certified thereto by the Director of the Geological Survey, and filed in the General Land Office "; the object of this being to place before the department the data upon which to recommend the location of the boundaries of the forest reserves, authority being given to the President in the amendment " to revoke, modify, or suspend any or all of such executive orders and proclamations, or any part thereof, from time to time as he shall deem best for the public interests."

In addition to the provisions for the survey and modification of the reserves, most important legislation for their future preservation, control, and administration was embodied in the act. It is provided that " the Secretary of the Interior shall make provision for protection against destruction by fire and depredations upon the public forests and forest reservations, and that he may make such rules and regulations, and establish such service as will insure the objects of such reservations, namely, to regulate their occupancy and use, and to preserve the forests thereon from destruction."

Provision is also made for the cutting and sale of the timber and the carrying on of mining and irrigation enterprises within the reserves, under permits to be granted and regulations to be established by the Secretary of the Interior. Essentially all the authority recommended in the final report of the Forestry Commission of the National Academy of Sciences is given by this legislation, with the exception of authority to employ troops in policing the reserves. The wording of the amendment is broad, and leaves the manner of establishing the administration and protection of the reserves in the control of the Secretary of the Interior. As soon as the surveys are completed, and the boundaries of the reserves determined, the final establishment of a rational forestry policy can be entered upon. Meantime, a beginning has been made through the authority granted by the act appropriating money for the protection of timber on public lands.

SURVEYS.—The forest-reserve legislation was enacted June 4, 1897, and arrangements were at once made for the topographic and subdivisional surveys of those portions of the suspended reserves in which there are large interests that may be injuriously affected if those areas are included within the reserves; for instance, the agricultural and mining interests of portions of the Black Hills Reserve of South Dakota, the mining interests of the southwestern portion of the Washington Reserve of Washington, and the timber interests of the eastern portion of the Bitter Root Reserve in Montana.

The topographic surveying parties were organized and left Washington the latter part of June. The purposes of the topographic surveys are (*a*) the preparation of topographic maps, on a scale of two miles to the inch, with contour intervals of one hundred feet, as base maps for the representation of forestry details, agricultural and mineral lands, and future geologic surveys; (*b*) the establishment of bench marks indicating elevation above sea level, for vertical control in topographic mapping, and for all mining, engineering, and geologic work; (*c*) the subdivision of reserves, where necessary, by running township lines for the purpose of designating tracts of land; (*d*) the demarcation by means of section lines of tracts which are more valuable as agricultural and mineral lands than for timber; and (*e*) the mapping by the topographer in charge of each party of the outlines of all wooded and forest areas.

Early in July the forestry survey was organized, and soon thereafter the special forest experts began the study of the distribution of the forests and woodlands, the size and density of the timber, the distribution of the leading economic species, the effect of the ravages of forest fires and the amount of damage inflicted by them, the amount of dead timber, the extent to which the forests are pastured,

and the extent of the timber already cut and the effects of the deforesting; also the relation of the timber supply to transportation, local demands of miners and settlers, and the supply needed for more distant markets.

The examinations of the surveyors and forestry experts are not limited to the present lines of the forest reserves, but, as provided for in the statute authorizing the survey, they include public lands adjacent to the reserves.

It is anticipated that the sixty thousand square miles of forests now included within the reserves can be thoroughly and economically surveyed within five years, provided adequate appropriations are made for the purpose. Nearly enough if not sufficient data for the construction of topographic and forestry maps have been secured during the past field season to permit of an intelligent rectification of the boundaries of most of the reserves containing areas where apparent injury or injustice is being inflicted by the establishment of the reserves.

The progress of the surveys during the short field season was slow, as the reserves comprise some of the most rugged mountain country in the West, much of which is covered with forests. No maps existed of the larger portion of the reserves. The surveys for the topographic and forestry maps of the Black Hills Reserve were completed, and for a considerable portion of the Big Horn Reserve. The forests were examined and the data platted, on Land Office and sketch maps, for the unsurveyed areas of the other suspended reserves, and a large body of information was secured in relation to the extent and character of the forests except on the Olympic Reserve.

The examination of the Priest River and Teton Reserves has been quite thorough, as well as that portion of the Bitter Root Reserve lying in Montana. The Washington Reserve has received the most careful examination in relation to its forest condition, although the topographic mapping and triangulation have been limited to the eastern and western sides of the divide of the Cascade Range. Triangulation has been initiated and extended over most of the Lewis and Clark and Flathead Reserves in Montana, and in the Uinta Reserve triangulation has been carried forward upon the small area mapped.

Late in October and November the surveying parties were withdrawn from the Northern States, owing to the severe weather, and several of them were transferred to southern California, where they are working in the San Gabriel and San Jacinto Reserves.

Cost and Profit of Forest Reserves.—Will it pay to maintain Government forest reserves? This question is best answered by referring to what has been done in other countries. The published

statements show that the annual receipts of the forest administration of Prussia are about $14,000,000, and the expenses about $8,000,000, leaving a net revenue to the Government of about $6,000,000. The annual revenue from the Government forests of France and Algiers exceeds $6,000,000, and the expenses for 1896 were estimated at $3,300,000. The net revenue of the great forest areas of British India for 1894–'95 was 7,415,590 rupees, or about $3,000,000. In British India the varied climate and the difficult sylvicultural conditions are similar to those found within the forest reserves and public forested lands of the United States. The total area of forest land under the control of the forest service of India in 1894–'95 was 112,952 square miles, of which 74,271 square miles were reserved forests, 7,090 protected forests, and 31,591 unclassed state forests. The total length of boundaries demarcated to June 30, 1895, in provinces under the Government of India alone was upward of 60,000 miles, and an area of 33,420 square miles is covered by topographic surveys. In a territory of 30,963 square miles, fires are kept in check, and 28,913 square miles are fully protected at a cost of about $2.60 per square mile, or less than one half cent per acre per annum.

The area administered by the forest service yielded, during the year 1894–'95, 46,000,000 cubic feet of timber, 100,000,000 cubic feet of fuel, 134,000,000 bamboos, and minor products to the value or 3,000,000 rupees or more. In this connection it should be borne in mind that systematic Government forestry in India is of recent growth. The first act was passed in 1865, although the management of the teak forests of Pegu was inaugurated some ten years before.

In Canada, where the physical and topographic conditions greatly resemble our own, the management of the Government forests devolves upon the department of Crown Lands, with an administrative bureau which is charged with public instruction in forestry as well as the supervision of the forested districts. The administration is under the charge of officers denominated Crown Lands and Timber Agents, having under them experienced woodmen called forest rangers, fire rangers, etc.

The total revenue from lumbering operations in the province of Quebec for the year ending June 30, 1896, amounted to $951,098.92. In Ontario the forested territory is divided into timber "berths" of different sizes, which are sold at auction to the highest bidder. At the last sale, in 1892, an average price was paid of $3,657.18 per square mile, subject to stumpage dues. The land is not sold, but is reserved for settlers, the person who has bought the right to cut the timber retaining the control of the land until it is required for settlement.

The cost of a permanent forest organization for the protection and utilization of the forests on the reserves is estimated by the National Forestry Commission at $250,000 per annum for the first five years. With a greater demand for forest supplies the annual expense will increase, but under any businesslike management the revenue from the sale of forest products will largely exceed the expense, yielding a handsome surplus to the Government. "When it is remembered that several million dollars' worth of timber are taken every year from the public domain without any recompense to the Government, it would appear to be a wise and economical policy to spend annually a few hundred thousand dollars on an organization which would prevent such unnecessary drains on the wealth of the nation; it must be remembered also that an efficient forest administration would be able to prevent many forest fires on the public domain, and that it is not an unusual occurrence for a single fire to destroy in a few days material worth more in actual money than this forest administration would cost in years, while the indirect loss to the country in impaired water flow is incalculable. The expenditure, therefore, of $250,000 a year in furnishing the means for protecting the forests on the public domain would appear to be justified by every consideration of common sense and economy." (Report of National Forestry Commission, p. 26.)

The experience of British India and Canada proves conclusively that Government control of the forests can be made profitable both to the Government and to the people using the forest products.

PROTECTION AGAINST FIRE.—The Ontario system provides for fire rangers, who are authorized to employ assistants to help suppress fires, and they are directed to notify the department if the fires are dangerous. The expense incurred in maintaining the forest staff and suppressing fires is shared between the Crown Lands Department and the owners of the licenses to cut timber. During the summer of 1895, ninety-three fires were reported, most of which were put out, the total loss by fire being only $41,600. This was effected by the employment of one hundred and fourteen men for a few months, at a total cost of $26,253.

The districts of upper and lower Ottawa during the summer of 1895, when it was unusually dry, experienced no serious conflagrations. No fewer than fifty-six incipient fires, however, were extinguished by the fire rangers, any one of which might have assumed serious proportions and caused heavy loss. The total loss in the district amounted to between five hundred and one thousand dollars.

In other districts in Quebec numerous small fires are extinguished every year by the forest rangers, which action prevents the destruction of thousands of acres of forests.

The forests of the western provinces of the Dominion are under the control of the Minister of the Interior, who follows the system adopted in the older provinces.

Within the forested areas of the United States the most destructive agent at present is fire. In comparison with it the damage done by pasturage in the Pacific coast States and by illegal timber cutting is insignificant. In a number of the Western States laws have been passed providing for the punishment of those who, by accident or design, set fire to the forests. There are so many agencies, however, by which fires may be started, such as sparks from locomotives, camp fires, lightning, as well as incendiarism, that it seems futile to attempt to prevent the burning of the forests unless there are competent forest guards to patrol them during the dry season.

There are no statistics showing the area of forests destroyed annually by fires in the United States, but during every summer smoke obscures for months the view of the sun over thousands of square miles. Once fully under way, a fire in a forest of coniferous trees will spread until it is extinguished by rain, or encounters some natural barrier like a river, or is driven back over its own course by a change in the direction of the wind. The only hope of averting the enormous losses which the country suffers every year from this cause lies in preventing the fires from starting, or in extinguishing them promptly. There is no doubt that they will always occur, but the experience gained in the Yellowstone National Park, and in Canada shows conclusively that with the aid of a disciplined forest patrol, intelligently directed, forest fires can be greatly reduced, and that it is frequently possible to extinguish small fires if properly handled when first discovered.

Mining Interests.—The mining interests of the Western States should be the most urgent in the demand for care and protection of the forests under Government direction. Upon the abundance or scarcity of timber will depend the development of many mining enterprises, and through them the advance or retardation of the growth of the State in which they are situated. That scarcity of timber will limit mining is without question, unless the mines are sufficiently rich to pay the added cost that transportation from a distant source of supply will entail. This will apply particularly to the small mine owner, and to the miner with little capital who wishes to develop promising prospects.

There is no doubt that the abundant timber supply of the Black Hills of South Dakota has given great impetus to the development of the mineral wealth of the region. It is equally true that if that timber supply is removed by being wasted, or is destroyed by forest fires, the future mining of the region will be limited to the working

of a few rich mines that can afford to pay high prices. Scarcity of timber all over the West is not a remote contingency if the present waste and destruction are permitted to continue; it is already in sight. Indeed, it will not be long before the magnificent forests of the Pacific coast will be so greatly injured by fire and wasteful cutting that the mining communities will have to draw their best timber from Canada and Alaska.

The opponents of the forest reserves have frequently stated that the reservation policy would cripple the mining industry. It is believed, however, that there would be much more truth in the statement that the destruction of the forests would seriously injure and in many instances ruin the mining industry. This industry demands a permanent source of supply of timber, and it hardly needs to be said that, without some such policy as that of forest reservation, no such source of supply can be maintained. If mining men can be brought to understand that their industry will be protected by the proper administration of the reserves, the future of both the mining and the lumber interests of the West will be provided for.

IRRIGATION INTERESTS.—A great industry like that of agriculture demands that in all regions where irrigation is carried on the source of the water supply be protected. The future existence of the farms, and to a large extent of the States themselves, depends upon the conservation of the water supply. The forest areas are largely the reservoirs in which the waters are controlled and given out to the adjacent irrigable districts. The experience of Europe and eastern Asia has shown that if the mountains are stripped of their forests, populous districts will become flood-swept deserts of rock and sand.

To illustrate the views of the leaders of the great irrigation development that is taking place in the arid and semiarid regions of the West, I will quote the resolution passed by the Irrigation Congress held in Lincoln, Nebraska, September 27 to 30, 1897:

"*Whereas*, The perpetuation of the forests of the arid region is essential to the maintenance of the water supply for irrigation, as well as the supply of timber; therefore

"*Resolved*, That the President of the United States be memorialized, as soon as adequate provision be made for the protection of the forests and the regulation of the cutting of timber therefrom, to withdraw from entry or sale, under the act of Congress of March 3, 1891, all lands now in its [the Government's] possession which are of more value for their timber than for agriculture or for minerals."

REFORESTING AND PASTURAGE.—There is little doubt that the present forests in the arid and semiarid regions are but the remnants of large forested areas that were developed during a period of greater rainfall than exists at present. Such being the case, although it is pos-

sible under existing conditions to continue the present forests by judicious cutting and care of the young growth, it will be impossible to reforest the lands if the present method of lumbering and pasturing and the annual forest fires are continued. Where the rainfall is limited to a few weeks or months, the only water available for forest growth during the remaining portion of the year is that held in the soil by the presence of the forest cover. The experience of all who have attempted to start young trees in the open, semiarid country has been that, unless artificially watered during the dry season, the young trees die under the influence of the scorching sun and hot, dry winds.

As the result of a personal inspection of a considerable portion of the Sierra forest reserve of California, I am fully convinced that the preservation and development of the agricultural interests of the great wheat and fruit districts west of the range depend largely upon the preservation and increase of the forest covering of the region whose drainage is tributary to the agricultural areas. The same is true of the Los Angeles and San Bernardino areas of the southwestern portion of the State. Where the forest and brush have been removed, either by fire, cutting, or pasturage, the slopes are dry and dusty, the water flows off almost as rapidly as it falls, and carries along with it a load of sand and gravel to be deposited in the irrigation ditches and over the fields of the lowlands.

A comparison of such a denuded area with an adjoining forested or brush-covered district shows at once that the forest covering must be preserved if the water supply is to be stored by natural means for irrigation.

Of the influence of sheep pasturage on reforesting there is a difference of opinion among men acquainted with the forest reserves. In the semiarid region the struggle for existence is so great that all vegetation needs and must have the advantage of every condition at all favorable to its growth, if it is to grow at all. If the herbage and seedlings are destroyed by pasturage and the tramping of the sharp hoofs of sheep, the fate of the future forest growth and storage of water is settled, and its destruction foreordained. In the well-watered sections of Oregon, Washington, north Idaho, north Montana, and perhaps the Big Horn Mountains of Wyoming, the effect of pasturage of sheep would be very slight, as the growth of vegetation is rapid and luxuriant; but in the Sierra and southern reserves of California and similarly conditioned areas the damage is great, and even the pasturage of cattle in many localities will be detrimental. As soon as the reserves are carefully and intelligently studied by practical foresters, I think it will be found that each reserve has peculiar conditions that must be considered before com-

plete regulations for the administration of each can be determined upon.

STATE AND PRIVATE OWNERSHIP OF FOREST LANDS.—The proposition to dispose of the public lands of the Government by giving them to the States in which they are situated has often been under discussion, and in this connection it has been suggested that if the Government will give the forested lands to the States they will be better taken care of than by the General Government. This may be true, but as long as the forestry question is an interstate problem there will be great difficulty in adjusting conditions within a State so as to do full justice to the interests of the adjoining States. This applies more largely to fire protection and the water for irrigation than to timber supplies. If the General Government, however, should not establish a permanent and successful forest policy, I believe that it would be much better to give the forested lands to the States than to continue the system of waste and destruction that has existed in the past. There is no doubt that under State adminstration something would be done, but the chances are that it would come too late to be of avail in the permanent protection of the forests.

Private ownership of forest lands within or adjoining the forest reserves can not but be detrimental to the interests of the forests and to the people to whom they are tributary. Both individuals and corporations purchase the forested lands for the purpose of profit, and when this is secured, either by the cutting of the timber or by sale to other parties, their interest ceases. It is very rarely, except in the case of very large holdings, that any attempt at protection against destruction by fire is made, but any one who has traversed the forests of the West in the vicinity of settlements has seen the results of the cutting of the timber. If it happens that firewood is marketable, the land is swept clean of every tree upon it, and great piles of brush are left scattered over the ground, ready to carry the first fire that may reach them to the adjoining forest, and destroy every vestige of vegetation that may have escaped the axe in the area cut over.

CONCLUSIONS.—The question of the forest reserves has both a practical and a sentimental interest. Its practical bearings are felt by the people of the States in which the reserves are situated, and by those interests in adjoining States which are dependent upon the reserves for their timber supply and, in the arid and semiarid States, for water for irrigation, without which it would be impossible for the population of large areas to exist. The sentimental interest is largely among the people who, without any direct values at stake, feel that the element of the population that would waste the forest

must be restrained in its tendency to destroy what is the common heritage of the people at large in all areas to which the forests are tributary. There is also a large class who believe that it is worth while to protect the animal life of the forests, and to set aside areas where in the future the crowded population of the nation may have great public parks open to all for health and sport.

There is a strong tendency among thoughtful citizens of the States in which the reserves are situated, and in adjoining States, to favor the protection and wise administration of the forests on the public domain, and as soon as it is made manifest that this will be accomplished by the reservation policy the sentiment in favor of the reserves will be as great among the people directly affected as among those who now advocate the existence of the reserves from sentiment. In opposition to this is the relatively small but very active and influential class composed of those whose personal interests are directly affected by the reservation policy. Their opposition is based on expectation of immediate gain, regardless of the future of mining or agriculture, of property rights of the Government, or of the rights of the future generations which may occupy the region affected by the presence or absence of forests. From their point of view, opposition to any forest policy is reasonable, as it affects their capital and income, but it can not be sustained as against the welfare of the masses of the people of this and future generations. The policy of forest reserves has evidently come to remain, provided the attempt is not made to accomplish too much at once without regard to the rights of those having homes or property within the limits of the reserves. It is also essential that the reserves should not be kept as idle parks a day longer than is absolutely necessary to establish a system of administration that will provide for the use of the timber, protect the immature trees and undergrowth, and permit of the development of the mineral resources.

If the reserves are judiciously selected and honestly administered, and thus made to commend the policy to the American people, the difficulties to be met will be of little moment. That the reserves will be of great benefit to the communities to which they are tributary is absolutely certain, and it is also certain that in time the policy of forest reserves will develop into one of the most popular, beneficial, and valuable institutions of the Government. It is based on the experience and mature judgment of the most intelligent and progressive nations of the world, and if properly planned and administered its future in the United States will be all that its strongest supporters hope for.

THE RACIAL GEOGRAPHY OF EUROPE.

A SOCIOLOGICAL STUDY.

(*Lowell Institute Lectures, 1896.*)

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XIII.—MODERN SOCIAL PROBLEMS.

HAS the intricate racial composition of the population of Europe, which we have been at so much pains to analyze, any significance for the student of social problems? Is there any reason why those who would rightly interpret sociological phenomena should first thoroughly acquaint themselves with the nature of the human stuff of which populations are compounded? Or have our conclusions, thus far, value merely as branches of investigation in pure science, a matter of academic interest alone? Such are the questions awaiting resolution at our hands in this paper of our series.

Let us begin by distinguishing between two equally competent and yet radically opposite explanations for any human phenomenon. One ascribes its origin to heredity, an internal factor; the other makes it a product of outward conditions—that is to say, of environment, social it may be, or physical. Thus the tall stature or blondness of an individual, a social class, or a people, may conceivably be due either to an inherited tendency from preceding generations, or else to the modifying influence of outer circumstances operative during a single lifetime.* Considering a single individual alone, a third factor—viz., chance variation—must needs be taken into account; but viewing men by wholesale, in large masses, this matter takes care of itself. Thus an odd drunkard, social reject, or criminal here and there in a community may be nothing more than an aberrant type; but if we discover a goodly proportion of such bad men, we are led to suspect a more fundamental cause. Chance does not work thus by wholesale, steadily in any given direction. Quetelet discovered this fact years ago. Confronted by any such phenomenon existing in appreciable proportions in any society, as revealed by statistical examination, we are therefore at once called upon to decide between our two original explanations. One runs it to earth, on the environmental theory; the other trees it in genealogical hypothesis. In plain English, it becomes a question of outward circumstances or else of inherited proclivities. On the first

* In the Political Science Quarterly, New York, x, 1895, pp. 642 *et seq.*, we have discussed this more fully.

supposition the phenomenon is of purely modern origin; in the second its roots are imbedded in the past. When the explanation thus becomes retrospective, if the people be in any wise homogeneous in characteristics, customs, or speech, we substitute another shorter word for inheritance. The whole matter simmers down to a decision between environment and race. Our problem in this paper is to adjudge a few such difficulties, whereby we may subserve a double purpose. We may discover what are the distinctive social peculiarities of the three races whose history we have been outlining; and we may form a definite idea of the class of remedies necessary to meet the peculiar needs of each community; for it is quite obvious that social evils due to inherited tendencies require very different treatment from those which are of recent origin, the product of local circumstances.

Purely environmental factors in social phenomena have been all too largely neglected by investigators in the past. At times they rise paramount to all other circumstances. One of the most striking instances of the influence of climate, for example, upon the distribution of population is offered by the present location of the cotton mills of Lancashire along the west coast of England. Why were these mills all set up about the city of Manchester, nearly a century ago? Why were they not placed where plenty of labor was at hand —viz., in the south and west, at that time the most densely populated district in England? The mills were not moved up into Lancashire, far from the crowd, because of the proximity to coal or iron. That may have in part induced them to remain there, when the choice had once been made. But before the days of the steam engine coal had no influence upon the selection of sites. Neither population nor coal being important elements, it is certain that climate was all-powerful in its attractiveness. Here, along the west coast, where the warm, moist Gulf-Stream winds blow steadily landward, is the most humid district in all England. In such an atmosphere the cotton fiber becomes naturally pliant and supple, rendering the spinning of thread a comparatively simple task. So considerable an element was this, that all sorts of devices were adopted for securing permanent benefit from the natural climatic endowment. Building sites were chosen on the western hill slopes, just where the humidity from the rising currents of air was greatest. Oldham and other towns above Manchester were located in accordance with it. Artificial ponds were created just west of the mills, so that the gentle winds blowing over them might become duly dampened. So subtle was this advantage that potted plants in the windows sometimes sufficed to humidify the air to just the right amount. Even to-day, with all the artificial devices for supplanting Nature's aid, we are

told by a manufacturer that a change of wind from east to west often makes a difference of seven or eight per cent in the product of a weaving shed.* To secure the precious humidity, factories have even at times been built half under ground, emulating the example of the Oriental makers of Dacca muslin, or "woven wind," who work sitting in holes in the ground, so that their delicate fabrics may be rendered supple by the moisture of the earth. Thus, perhaps, acting in this way, has the factor of climate been able to overcome the inertia of the large population once centering in southern England; for it has been compelled to transfer itself to the spot marked out by Nature for the industry.

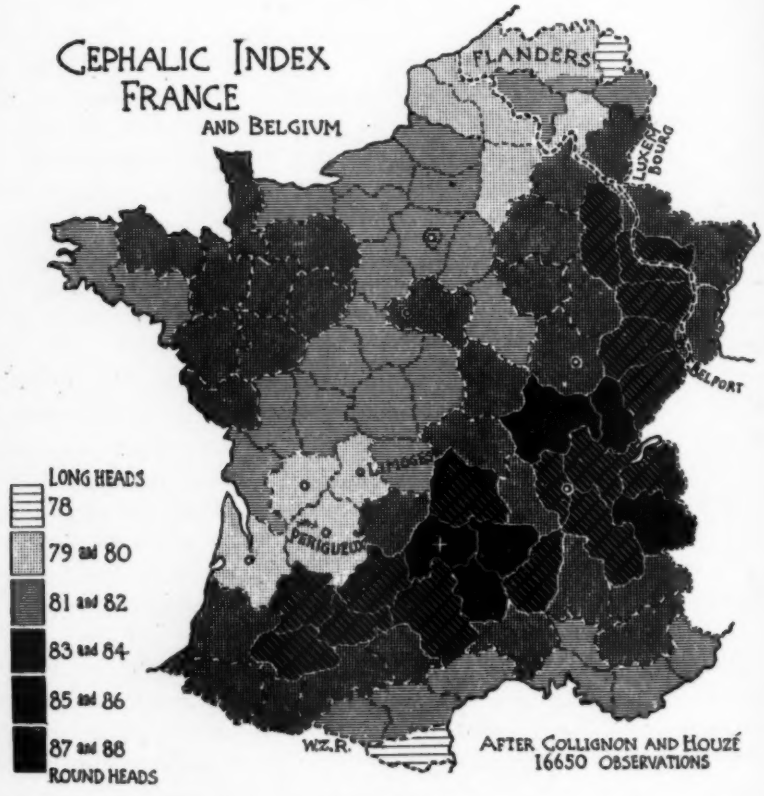
To decide between race and environment as the efficient cause of any social phenomenon is a matter of singular interest at this time. A school of sociological writers, dazzled by the recent brilliant discoveries in European ethnology, show a decided inclination to sink the racial explanation up to the handle in every possible phase of social life in Europe. It must be confessed that there is provocation for it. So persistent have the physical characteristics of the people shown themselves, that it is not surprising to find theories of a corresponding inheritance of mental attributes in great favor. Yet it seems to be high time to call a halt when this "vulgar theory of race," as Cliffe-Leslie termed it, is made sponsor for nearly every conceivable form of social, political, or economic virtues or ills, as the case may be.

This racial school of social philosophers derives much of its data from French sources. For this reason, and also because our anthropological knowledge of that country is more complete than for any other part of Europe, we shall confine our attention primarily to France. Let us refresh our memories of the subject. For this purpose we reproduce herewith a map from a former article, showing the distribution of the head form.† This we hold to be the best expression of the racial facts. On this map the dark tints show the localization of the Alpine broad-headed race common to central Europe in the unattractive upland areas of isolation. The light tints at the north, extending down in a broad belt diagonally as far as Limoges and along the coast of Brittany, denote the infusion of the blond, long-headed Teutonic race; while the similar light strip along the southern coast, penetrating up the Rhône Valley, measures the extension of the equally long-headed but brunette Mediterranean stock. The dotted area about Périgueux, in the southwest, we have

* For interesting data upon this point consult Transactions of the New England Cotton Manufacturers' Association, No. 57, pp. 185 *et seq.*; Edward Atkinson, in the Popular Science Monthly, 1890, pp. 306 *et seq.*

† Popular Science Monthly, vol. li, 1897, pp. 289 *seq.*

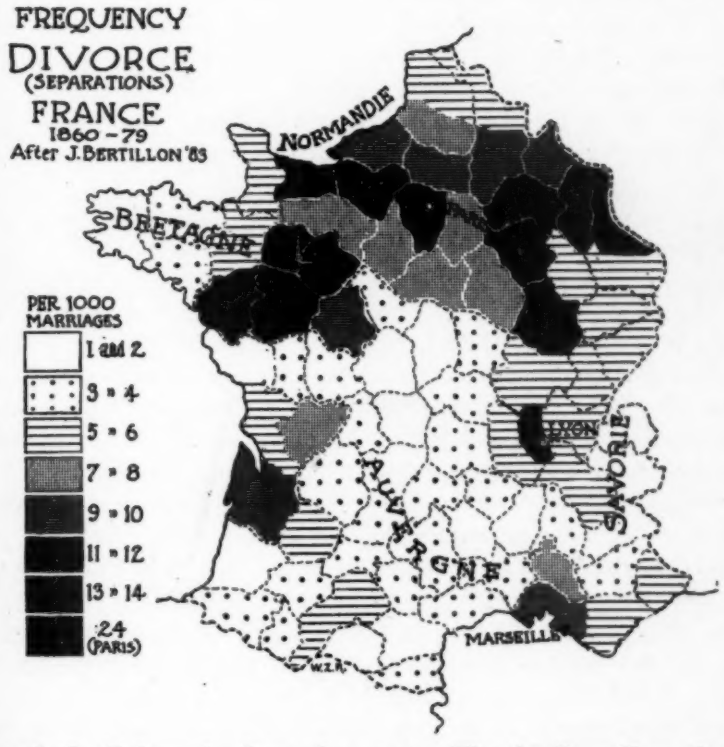
surely identified as a bit of the prehistoric Cro-Magnon race persisting here in relative purity. These ethnic facts correspond to physical ones; three areas of geographical isolation dark-colored are



distinct centers of distribution of the Alpine race. These differ in intensity. The high Alps of Savoy are the most isolated of all; Auvergne, the south central plateau, follows next in order. These two are populated by quite pure Alpine types. Brittany, most accessible of the three, contains only an attenuation of this broad-headed race, the Teutons having infiltrated through it quite generally.

The organization of the family is the surest criterion of the stage of social evolution attained by a people. No other phase of human association is so many-sided, so fundamental, so pregnant for the future. For this reason we may properly begin our study by an examination of a phenomenon which directly concerns the stability of the domestic institution—viz., divorce. What are the facts as to its distribution in France? Owing to the influence of the Catholic Church, no actual divorces were allowed by law in that country prior

to 1884; but what were known as "*séparations de corps*," or judicial separations, were regularly granted. From data derived from the best authorities, we have prepared the map on this page, showing its relative frequency in different parts of the country. The dark tints correspond to the areas where it is most common. From this map it appears that marked variations between different districts occur. Paris is at one extreme; Corsica, as always, at the other. Of singular interest to us is the parallel which at once appears between this distribution of divorce and that of head form. The areas of isolation peopled by the Alpine race are characterized by almost complete absence of legal severance of domestic relations between husband and wife. The correspondence appears to be defective in Brittany, but this is largely because of arbitrary departmental boundaries. Savoy and Auvergne certainly show infrequency of such judicial separations on this map, a social characteristic which extends clear to the Pyrenees, in just the same way that the Alpine broad-headedness occupies the same country. A narrow Mediterranean strip seems to



be marked off from it along the coast. The fertile valley of the Garonne is clearly outlined by increased frequency of separations, in marked contrast to the highlands on either side. This is, of

course, partly due to the concentration of population in cities along the river; for divorce is always more frequent in urban than in rural communities. The same consideration may also be important along the Mediterranean coast, for a large part of the population is here aggregated in cities, for peculiar reasons which will appear in due time. Even more strikingly the great basin of the Seine, center of Teutonic racial characteristics, stands sharply marked off from the whole south. This is most important of all.

Do the facts instanced above have any ethnic significance? Do they mean that the Alpine type, as a race, holds more tenaciously than does the Teuton to its family traditions, resenting thereby the interference of the state in its domestic institutions? A foremost statistical authority,* Jacques Bertillon, has devoted considerable space to proving that some relation between the two exists. Confronted by the preceding facts, his explanation is this: that the people of the southern departments, inconstant perhaps, and fickle, nevertheless are quickly pacified after a passionate outbreak of any kind. Husband and wife may quarrel, but the estrangement is dissipated before recourse to the law can take place. On the other hand, the Norman or the Champenois peasant, Teutonic by race, cold and reserved, nurses his grievances for a long time; they abide with him, smoldering but persistent. "Words and even blows terminate quarrels quickly in the south; in the north they are settled by the judge." From similar comparisons in other European countries, M. Bertillon draws the final conclusion that the Teutonic race betrays a singular preference for this remedy for domestic ills. It becomes for him an ethnic trait.

Another social phenomenon has been laid at the door of the Teutonic race of northern Europe; one which even more than divorce is directly the concomitant of modern intellectual and economic progress. We refer to suicide. Morselli devotes a chapter of his interesting treatise upon this subject † to proving that "the purer the German race—that is to say, the stronger the Germanism (e. g., Teutonism) of a country—the more it reveals in its psychical character an extraordinary propensity to self-destruction." On the other hand, the Slavic peoples seem to him to be relatively immune. These conclusions he draws from detailed comparison of the distribution of suicide in the various countries of western Europe, and it must be confessed that he has collected data for a very plausible case.

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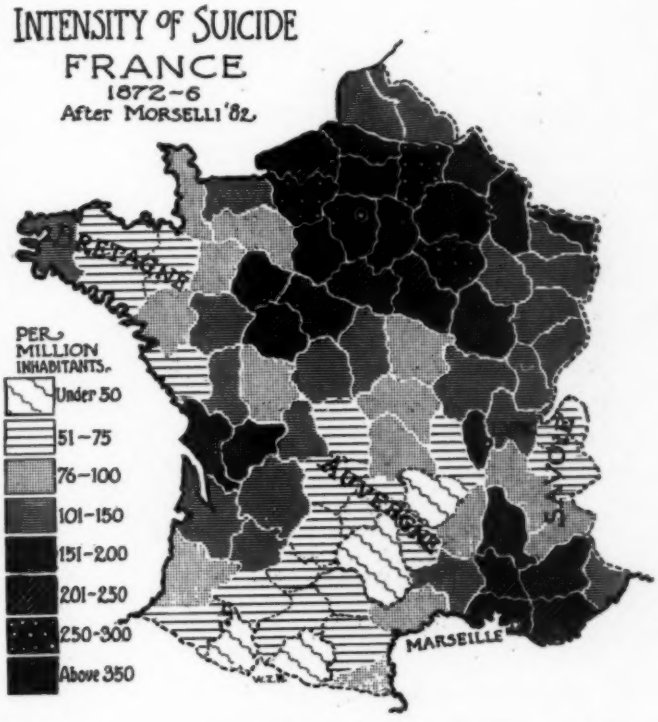
* Études démographiques du divorce, Paris, 1883, pp. 42 *seq.* Turquan, in L'Économiste Français, October 26, 1889, gives parallel results for the first five years of the new divorce law of 1884.

† Suicide, in the International Scientific Series, New York, 1882. A. M. Guerry, Statistique Morale, Paris, 1864, shows precisely the same thing.

There can be no doubt that in Germany the phenomenon culminates in frequency for all Europe, and that it tends to disappear in almost direct proportion to the attenuation of the Teutonic racial characteristics elsewhere.

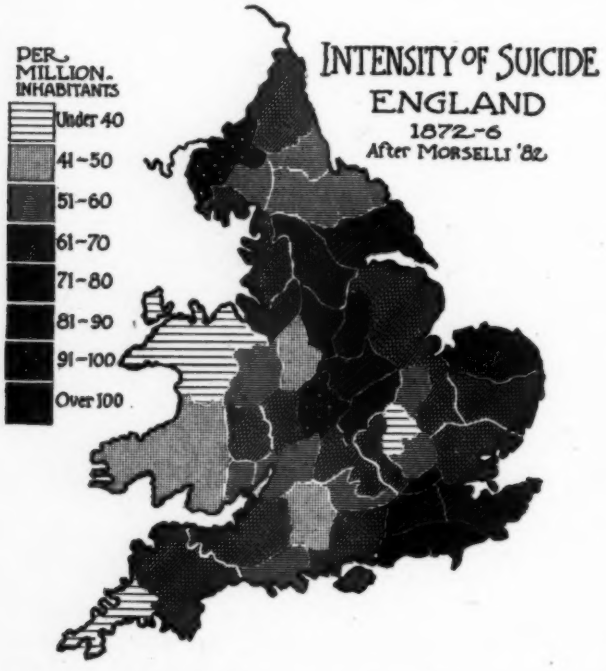
Consider for a moment our map on this page, showing the relative frequency of suicide, with the one on page 472, which we have already described as illustrating the ethnic composition of France. The parallel between the two is almost exact in every detail. There



are again our three areas of Alpine racial occupation—Savoy, Auvergne, and Brittany—in which suicide falls annually below seventy-five per million inhabitants. There, again, is the Rhône Valley, and the broad, diagonal strip from Paris to Bordeaux, characterized alike by strong infusion of Teutonic traits and relative frequency of the same social phenomenon. The great Seine basin is sharply differentiated from the highlands along the eastern frontier; and even the Mediterranean coast strip, distinct from the Alpine and Auvergnat highlands, is indicated. Inspection of these maps betrays at once either a relation of cause and effect or else an extraordinary coincidence.

Consideration of the distribution of suicide in England lends

still greater force to Morselli's generalization. Herewith is a map of its variations. Observe how Wales and Cornwall are set apart from all the rest of the island. Were the map more extensive, we should discover the Scottish Highlands, the third stronghold of the ancient Briton types, characterized by an equal infrequency of suicide. Most remarkable of all is the little light-colored area, just north of London, comprising the counties of Hertfordshire, Bedford, and Huntingdon. This district we were at great pains to emphasize in



our article upon the British Isles as a region where the physical characteristics of the pre-Teutonic invaders of the island were still represented in comparative purity. We saw that the conquering Teutons entered England from two sides, avoiding London and the impenetrable fen district, and thereby passed over this region, leaving it notably brunette in physical type to this day. Here, again, in nearly every detail of our map would seem to be a corroboration of Morselli's law. For suicide diminishes in direct proportion to the absence of Teutonic intermixture.

Divorce and suicide, which we have just discussed, will serve as examples of the mode of proof adopted for tracing a number of other social phenomena to an ethnic origin. Thus Lapouge attributes the notorious depopulation of large areas in France to the sterility incident upon intermixture between the several racial

types of which the population is constituted. This he seeks to prove from the occurrence of a decreasing birth rate in all the open, fertile districts where the Teutonic element has intermingled with the native population.* The argument has been advanced a stage further even than this; for purely economic phenomena, such as the distribution of property, tax-paying faculty, and the like, are in the same way ascribed to purely racial peculiarities.† Because wealth happens to be concentrated in the fertile areas of Teutonic occupation, it is again assumed that this coincidence demonstrates either a peculiar acquisitive aptitude in this race, or else a superior measure of frugality.

By this time our suspicions are aroused. The argument is too simple. Its conclusions are too far-reaching. We can do better for this race than even its best friends along such lines of proof. With the data at our disposition there is no end to the racial attributes which we might saddle upon our ethnic types. Thus, judging from mere comparison of our map of head form with others of social statistics, it would appear that the Alpine type in its sterile areas of isolation was the land-hungry one described by Zola in his powerful novels. For, roughly speaking, individual landholdings are larger in them on the average than among the Teutonic populations. Peasant proprietorship is more common also; there are fewer tenant farmers. Crime in the two areas assumes a different aspect. We find that among populations of Alpine type in the isolated uplands offenses against the person predominate in the criminal calendar. In the Seine basin, along the Rhône Valley, wherever the Teuton is in evidence, on the other hand, there is less respect for property; so that offenses against the person, such as assault, murder, and rape, give place to embezzlements, burglary, and arson.‡ It might just as well be argued that the Teuton shows a predilection for offenses against property; the native Celt an equal propensity for crimes against the person. Or, again, why does not the Alpine type appear through statistical eyes as endowed with a peculiar aptitude for migration? For the sterile upland areas of his habitation are almost invariably characterized by emigration to the lowlands and to the cities.

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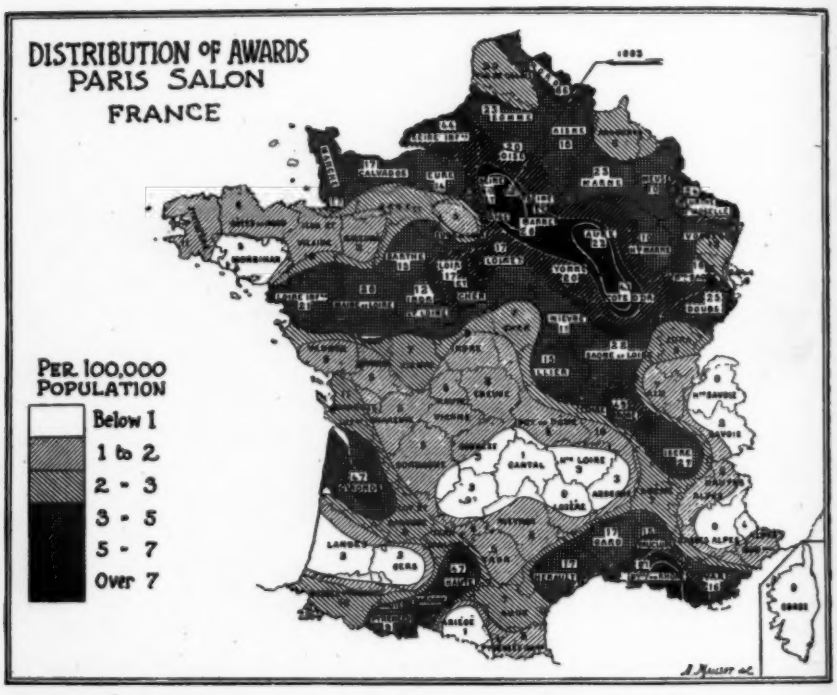
* Revue d'Économie Politique, ix, 1895, pp. 1002–1029; x, 1896, pp. 132–146. This we have already discussed in Publications of the American Statistical Association, v, 1896, pp. 18 *et seq.*

† Corrélations financières de l'indice céphalique, Revue d'Économie Politique, 1897, p. 257. See also The hierarchy of European races, in American Journal of Sociology, Chicago, iii, 1897, pp. 314–328.

‡ For maps showing the distribution of all these, consult A. M. Guerry, Statistique Morale, etc., Paris, 1864. Fletcher, in the Journal of the Royal Statistical Society, London, xii, 1849, pp. 151 *seq.*, gives many interesting maps for England. See also Yvernes, in Journal de la Société de statistique, Paris, xxxvi, 1895, pp. 314–325.

The persistence of a higher birth rate in these districts makes such relief to an ever-increasing population necessary. Finally, why not apply the same mode of proof to the artistic or literary attributes of population? Turquan* has recently mapped the awards made by the *Salon*, at Paris, according to the place of birth of the artist. We reproduce this directly herewith, not because it proves anything racially, but because it might as well be adduced as proof of the artistic bent of Teutonism in France as many another map above mentioned. For, broadly viewed, the artistic instinct, measured by the canons



of the *Salon's* judges, seems to cling persistently, as Turquan concludes, to the fertile river basins, which are the great centers of Teutonic populations. Nevertheless, we are convinced, despite the geographical coincidence, that it is not the factor of race, but rather of social environment, education, the inspiration of contiguous culture, which is really the responsible agent in the case. That it is not race but rather circumstances which makes for these higher things in civilization, we may, I think, prove, if we but include a number of different countries within the purview of our comparisons. We are fortunate in possessing an artistic census of Italy, not incom-

* La Statistique aux Salons, Revue Politique et Littéraire, Paris, série 4, vi, 1896, pp. 207 *seq.*

parable with that of France.* Bellio has distributed the poets, painters, and sculptors of antiquity according to their place of birth, over a map of that country. The effect has been to emphasize the enormous preponderance of artistic genius all through the north, from Tuscany to the Alps. How does this coincide with our previous deduction concerning France? It seems, perhaps, to corroborate the relation of Teutonism to art, until we recall the fact that all northern Italy is overwhelmingly Alpine by race, as compared with the artistically sterile south. Couple with this the fact that in reality Teutonism is a negligible factor in Italy, physically speaking, and that precisely the same ethnic type in France, which is so fecund culturally in Italy, is the one localized wherever art is not; and all doubt as to the predominant cause of the phenomenon is dissipated. We see immediately that the artistic fruitfulness in either case is the concomitant and derivative product of a highly developed center of population. Contact of mind with mind is the real cause of the phenomenon.

This mode of destructive criticism, appeal to the social geography of other countries wherein the ethnic balance of power is differently distributed, may be directed against almost any of the phenomena we have instanced in France as seemingly of racial derivation. In the case either of suicide or divorce, if we turn from France to Italy or Germany, we instantly perceive all sorts of contradictions. The ethnic type which is so immune from propensity to self-destruction or domestic disruption in France, becomes in Italy most prone to either mode of escape from temporary earthly ills. For each phenomenon culminates in frequency in the northern half of the latter country, stronghold of the Alpine race. Nor is there an appreciable infusion of Teutonism, physically speaking, herein, to account for the change of heart. Of course, it might be urged that this merely shows that the Mediterranean race of southern Italy is as much less inclined to the phenomenon than the Alpine race in these respects, as it in turn lags behind the Teuton. For it must be confessed that even in Italy neither divorce nor suicide is so frequent anywhere as in Teutonic northern France. Well, then, turn to Germany. Compare its two halves in these respects again. The northern half of the empire is most purely Teutonic by race; the southern is not distinguishable ethnically, as we have sought to prove, from central France. Bavaria, Baden, Würtemberg are no more Teutonic by race than Auvergne. Do we find differences in suicide, for example, following racial boundaries here? Far from it; for Saxony is its culminating center; and Saxony, as we know, is really half Slavic by heart,

* Rapporti fra l'etnografia antica dell' Italia e la sua produttiva artistica, Boll. Soc. geog. Italiana, Roma, xxiii, 1886, pp. 261–279, maps.

as is also eastern Prussia. Suicide should be most frequent in Schleswig-Holstein and Hanover, if racial causes were appreciably operative. The argument, in fact, falls to pieces of its own weight.

A summary view of the class of social phenomena seemingly characteristic of the distinct races in France, if we extend our field of vision to cover all Europe, suggests an explanation for the curious coincidences and parallelisms above noted, which is the exact opposite of the racial one. In every population we may distinguish two modes of increase or evolution, which vary according to economic opportunity for advancement. One community grows from its own loins; children born in it remain there, grow up to maturity, and transmit their mental and physical peculiarities unaltered to the next generation. Such a group of population develops from within, mentally as well as physically, by inheritance. Such is the type of the average rural community. It is conservative in all respects, holding to the past with an unalterable tenacity. Compare with that a community which grows almost entirely by immigration. Stress of competition is severe. There is no time for rearing children; nor is it deemed desirable, for every child is a handicap upon further social advancement. Marriage, even, unless it be deferred until late in life, is an expensive luxury. Population grows, nevertheless; but how? By the steady influx of outsiders. Such is the type known to us in the modern great city. Between these two extremes are all gradations between the progressive and the conservative type of population. To the former are peculiar all those social ills which, as Giddings has rightly urged, are the price paid for such progress. Suicide is a correlative of education; frequency of divorce is an inevitable concomitant of equality of rights between the sexes, and the decline of the religious sanction of *patria potestas*. A decreasing birth rate almost always attends social advancement. To prevent such a fall in the birth rate, and at the same time to overcome the devastations of disease, is held by many to be the demographic ideal to which all states should aspire. Not postponed marriages, not childless families, not a high proportion of celibates; not, on the other hand, reckless and improvident unions, with a terrific infant mortality as a penalty therefor; but a self-restrained and steady birth rate in which a high percentage survive the perils of infancy. "Civilization is the baptism of the passions. In the cloister neither does the mother die of fever nor the child of croup; but outside the cloister to find both mothers and children, and bring both well through fever and croup—that is civilization." * Could we for

* From a very suggestive paper, A Measure of Civilization, in Journal of the Royal Statistical Society, London, lx, 1897, pp. 148–161.

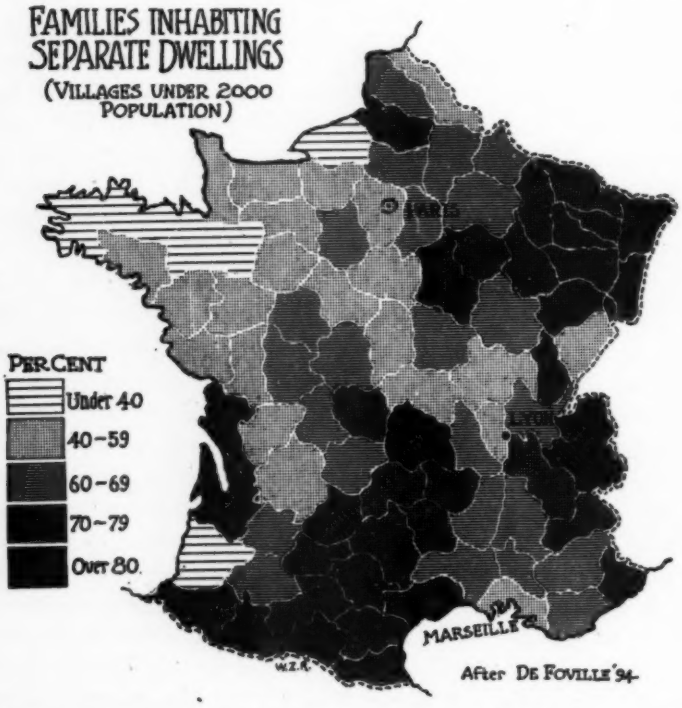
France apply this last-named criterion of progress? I doubt not we should find it to accord with all the facts we have instanced above. To ascribe them to racial causes is to lose sight of the primary factors in social evolution.

Our theory, then, is this: that most of the social phenomena we have noted as peculiar to the areas occupied by the Alpine type are the necessary outcome, not of racial proclivities, but rather of the geographical and social isolation characteristic of the habitat of this race. The ethnic type is still pure for the very same reason that social phenomena are primitive. We discover, primarily, an influence of environment where others perceive phenomena of ethnic inheritance. In the preceding paragraph we have referred to the apparently disintegrating influence of social evolution upon domestic institutions. Let us for a moment turn to another phase of family life in France, in order to illustrate the complex forces which play upon it to-day. The danger of rashly generalizing from inadequate data will be immediately apparent.

An index of the solidarity of the family is afforded by the degree to which it resents the interference of the state in its domestic affairs. A similar expression of the force of family feeling is often rendered through the tenacity with which it holds itself aloof from the intrusion of strangers not allied by blood or adoption to the other members of the naturally close corporation. In other words, statistics of what we may call "home families," or families occupying an entire dwelling by themselves, give us a clew to the cohesiveness of the institution. It is the question of the boarding house and the tenement *versus* the home. Any direct comparison in this respect between different parts of the same country is of course entirely worthless, unless we take account of the relative proportions of city population in each; for, always and everywhere, it is in the crowded city that the "home" is superseded by its degenerate prototypes. Fortunately, we possess for France data upon this subject, with the necessary elimination of this cause of error. The accompanying map shows the proportion of families occupying each a whole house to itself, and with the exclusion of all cities of upward of ten thousand inhabitants in every case. In other words, we have before our eyes statistics of the separately existing families among the French peasantry.

Inspection of this map of "home families" shows the widest range of variation. Some parts of France, notably Brittany, exhibit twice the degree of domestic intermixture, so to speak, that prevails in other regions. On the whole, the northwest manifests a weaker opposition to the intrusion of strangers in the family circle than does the south. In some respects this agrees with the testi-

mony of divorce, as to the cohesiveness of the domestic institution. So far as Savoy, Alsace-Lorraine, and Auvergne, our principal areas occupied by the Alpine or Celtic race, are concerned, the parallel with the map of divorce is quite close. The Mediterranean coast strip, nay, even the intrusive zone up the Rhône Valley, are indicated as areas where the family is less cohesive than in the upland areas of isolation. But what shall we say about Brittany? Racially, and in stability of the family as well, it belongs with Savoy



and Auvergne as an area of isolation, characterized by comparatively backward social phenomena. Nevertheless, inspection of our map shows it to be the region where such "home intermixture" is exceedingly prevalent. Less than one half the families live under entirely separate roofs, whereas in the other Celtic areas the proportion of independent families is often above ninety per cent.

This peculiar anomaly in the case of Brittany is all the more notable, as this region is one of the most conservative in all France, judged by the character of its social phenomena. Some disturbing factor is evidently at work. It seems to be purely environmental. Surprising as it may appear, this exaggerated "home intermixture" in the Armorican peninsula is apparently to a large degree referable to its geological and climatic peculiarities. Levasseur makes some

interesting observations upon this subject.* Where peasant houses are closely aggregated or bunched in little villages, it is easy for each family to maintain its separate dwelling, and yet for them all to co-operate with one another in daily labor. On the other hand, the peasant whose house is quite apart from those of his neighbors, placed squarely, perhaps, in the center of his landed property, must of necessity take his farm laborers into his own household. Thus, where population is scattered evenly over a district, not in closely built hamlets, but in widely separated houses, it generally happens that there is considerable "home intermixture." Several families or parts of families live under the same roof. Applying these considerations to Brittany, it seems as if the very low percentage of separate "home families" were a result of just such a broadcast distribution of population. This absence of hamlets in turn is a direct result of geology and climate. In Brittany the rainfall is very heavy; water courses and springs abound on all sides. The soil is at the same time thin, overlying an impervious granite formation. This makes it possible to build houses wherever convenient, without anxiety concerning water supply. The exact opposite of this occurs along the dry Mediterranean coast, where water is a marketable commodity; and in those departments with a permeable chalk soil, where water disappears rapidly in subterranean streams. In these latter cases houses inevitably collect about the water courses and springs, and a high proportion of aggregated population at once is manifested, with all that is thereby implied, socially speaking. One of the first results would be that each family in such a hamlet might occupy its own dwelling exclusively.

Geographical factors have also operated in still another way in Brittany to discourage the growth of closely built villages. This region is so remote from any of the routes of military invasion from the east that no necessity has ever arisen for compacting the population in villages capable of ready defense. Levasseur gives this as an important element in producing the contrasts in the proportion of urban population between the different parts of France. In all of our areas of isolation, the Alps, Auvergne, or Brittany, protected by Nature against intrusion of enemies, the population can safely scatter as it will. In any case, as we have said, the effect upon the family, especially in all that concerns its separate existence under a roof by itself, is very patent.

If the geographical isolation peculiar to the areas occupied by the Alpine race is thus potent in the way we have indicated, why may it not appear in political as well as in social affairs? Conserva-

* Bulletin de l'Institut Internationale de Statistique, iii, 1888, pp. 70 *et seq.*

tism should be its motto. To test this we have studied minutely the results of a general election of deputies from all over France, held in 1885. We chose this example for the reason that this important political event was the last supreme effort, the expiring gasp of the monarchical party in France. It is the last time that the conservative element obtained any formidable representation in the Chambers at Paris. From ninety-five deputies standing for a return to the old *régime* in the preceding Chambers, the number advanced to one hundred and eighty-three; it nearly doubled, in other words. Three million three hundred thousand conservative votes, in a total suf-

frage of 7,500,000, was a very respectable, even formidable, showing. This remarkable overturn was due to a fortuitous conjuncture of events. The Ferry republican ministry had been recklessly extravagant; its policy in Tonquin was unpopular. Disturbing local issues were, however, rare, so that the main questions at home were calculated to appeal directly to any intellectual or moral prejudices which happened to be abroad. The Radical party stood for the separation of Church and State; universal suffrage in senatorial and presidential elections was a leading issue. It was an exceptional occasion in every respect for reviving the smoldering fires of conservatism, while at the same time affording opportunity for the fullest expression of progressive ideas, wherever they were present. The election,

therefore, was squarely a question of the old *versus* the new. By analysis of its results, we may perhaps gain an inkling of the temper of the people.

Our map herewith denotes by its lightest shades the areas of most advanced modern ideas where the radicalism of the nineteenth-century type had cut itself loose from all bonds with the past. The opposite extreme, where both politics and religion combined to rejuvenate the conservative party, is tinted black. The intermediate gradation of sentiment is demonstrated by the degrees of light or dark shading. Inspection of this map reveals a certain parallelism with all those that we have studied heretofore. Especially do we note the conservatism of Brittany, Auvergne, and the southwest. It should be said that the apparent conservatism of the most northern departments was due to the local protection-and-free-trade issue, complicated by the Boulanger episode. For this reason these manufacturing centers should be eliminated from our comparison. Savoy and the high Alpine departments also were strongly affected by their proximity to the republican institutions in Switzerland. We must allow for that fact also. A curious contrast, ever persistent in all our ethnic or social maps, is that which is manifested between the coast strip along the Mediterranean and the mountains north of it. A light strip of radicalism extends all along the sea and up the Rhône Valley, setting apart Auvergne from Savoy. Whether this radicalism bears any relation to the high percentage of urban population hereabouts—a product partly of climate, as we have seen—or whether it is an expression of the impulsive temperament of the Mediterranean race, we leave it to others to decide. It is a fact, at all events.

Having made allowance for all the disturbing factors above named, it is roughly true that the areas of Alpine racial occupation manifest a distinct tendency toward conservatism in politics. We incline to the belief that here, again, is the influence of physical circumstances appreciable. Cliffe-Leslie, keenly alive to the weakness of the old dollars-and-cents political economy, may have been right, after all. He concludes: "One may, I think, point with certainty to the difference of environment and conditions of life in the mountains and in the plains, as the source of the superior force of religion, family feeling, and ancient usage in the former. On its moral and social side the contrast between mountain and plain is the contrast between the old world and the new; between the customs, thoughts, and feelings of ancient and modern times." Politics at one extreme, ethnology at the other, have afforded us constant proof of the truth of this generalization. The close interrelation which of necessity exists between every form of human phenomenon in a

naturally developed society is a second corollary from the same law. Of profound significance for the sociologist, however, is the fact that to-day we are rapidly passing from such natural organization to a new and highly artificial one. Problems of city life confront us on every side. They are not devoid of ethnic importance; investigation is concentrating upon them. In the final paper of our series we shall proceed to their consideration.

SCIENTIFIC PROGRESS IN THE CLOSING CENTURY.*

By Prof. LUDWIG BÜCHNER.

CENTURY of enlightenment—century of science—century of reconciliation—as such respectively may be characterized the eighteenth, the nineteenth, and the twentieth centuries; though in so characterizing the last we have somewhat forestalled time. But the designation of the present century as that of science can hardly be disputed; for progress in human knowledge and in consequent power has been so great and far-reaching in this century, and so rapid within the last few years, that in this respect no preceding century can at all compare with this.

Astronomy.—It is known that Copernicus, fearing clerical persecution, was compelled to hold back his great work on the revolutions of the heavenly bodies for thirty years, and that when finally published it was condemned and prohibited as heretical. The telescope also was put under the ban, because, according to the view of the Church, it permitted men to see farther than God by the structure of the human eye intended them to see. Nevertheless, it was the telescope that put a definite end to the narrow notions arising from the geocentric error, and ousted the earth and its inhabitants from their imagined high place as center of the universe. But the crowning of the astronomical edifice founded on these discoveries occurred only in the century at whose exit we are standing, and this through the founding of the important science of astrophysics and the knowledge acquired thereby of the chemical and physical constitution of the heavenly bodies by which we are surrounded. These researches were initiated by the wonderful discovery made in 1859 by Kirchhoff and Bunsen of the spectral analysis or the language of light, which has furnished special elucidation of the chemico-physical constitution of the sun, which elucidation must have appeared impossible to previous science. Spectrum

* From Prof. Ludwig Büchner's book, Am Todtenbett des Jahrhunderts, which is about to be published in Germany.

analysis, also, in conjunction with the study of the curious double stars (which have been more exactly recognized within the last decade and are now known by the thousand) has brought about the highly important conviction of the unity of what is to us the visible universe, and the correspondence of its elements and forces and of the laws by which the whole is governed. In the same science, the progressive improvement of the astronomical perspectives and giant telescopes has furthermore made possible a much more extended insight into the infinite depths of the universe, and, supported by the art of photography, has made known the existence of new stars—among them fixed stars or suns—a hundred or a thousand times as great as our sun. Even more important is the discovery in the same manner of those strangely rotating primeval nebulæ, composed of incandescent gases, which are nothing else than stellar systems in a state of formation. Observation of these has raised to almost a certainty the theory of Kant and Laplace as to the origin of those systems. One of the strangest of those systems is the great nebula in Andromeda which can be seen with the naked eye. The photographic image of this object, obtained by the English astronomer Dr. Roberts, by means of a twenty-inch reflecting telescope, exhibits distinctly the various phases of its development. The improved telescopes of the present time have furthermore provided us with such an intimate knowledge of the constitution of the surface of our moon that it is now better known than some parts of the surface of the earth—as in the interior of the great continents of Africa, Australia, and America. Similar information, though to be taken with reserve, was obtained from the remarkable phenomena observed on the surface of the planet Mars. The interpretation of these features has not been thus far absolutely settled, but in the opinion of eminent astronomers they indicate the presence on that planet of thinking beings. To the present century also belongs the somewhat older discovery of the planet Neptune, which was made in such a wonderful way by Leverrier and Galle in 1846. This discovery must be regarded as one of the greatest triumphs of astronomical science, since it was the fruit of a demonstration by mathematical calculations of the existence of a heavenly body, while the actual finding and identification of it were achieved afterward by means of the telescope. In like manner, by the application of the laws of gravitation to the peculiar movements of the magnificent fixed star Sirius (the Dog Star of the ancients), its character as a double star was recognized twenty years before Clark, in Boston, discovered, on January 31, 1862, its companion, and by this discovery furnished the weightiest argument in support of the universality of the law of mass attraction.

PHYSICS.—With astronomical science ranks, as a matter of course, physical science and the great discovery of the conservation or persistence of force, which now like an animating breath pervades all natural sciences, and deserves to be classed with the greatest discoveries of all time. Guessed and clearly predicted by Friedrich Mohr as early as 1837, this principle received its scientific confirmation from the German Robert Mayer (1842) and the Englishman Joule (1842–'49). Both these scientists had worked independently of each other. The validity of this great theory was first established by proving the identity of heat and motion (because proof as to these was easiest), and, the mechanical equivalent of heat having been calculated, was very soon fixed for all the forces of Nature. Thus the unity and immortality of force were demonstrated.

The physics of our century shows another great advance in what is called the kinetic theory of gases, for which Clausius and Maxwell paved the way, and which permits us a deep insight into the infinite fineness of matter and the inconceivable velocity of its internal motion. According to Clerk Maxwell, the most minute living being that can be seen under the most powerful microscope still contains a million (according to Tait, two million) organic molecules or atomic groups; so that we can not form any conception whatever of the incalculably great number of the finest histological elements for which perhaps no method of investigation is at our command. Finally, the century, shortly before its departure, has accomplished in the physical domain one of its most valuable feats by the discovery of the X or Röntgen rays, which permit our eye to penetrate to the innermost depths of objects hitherto regarded as opaque, and thereby make almost true the marvels of the Arabian Nights. Not less wonderful and unexpected is the success, likewise belonging to very recent time, attained by the experiments in liquefying and solidifying gases, like oxygen, nitrogen, carbonic acid, chlorine gas, and atmospheric air.

CHEMISTRY.—As regards the domain of chemistry, this science, not to mention the numerous smaller discoveries important to industry and therapeutics, has achieved one of its greatest triumphs by its surprising penetration into the organic domain, and the consequent elucidation of the relation of the vegetable and animal metabolism. These discoveries, chiefly initiated by the renowned Liebig, in the years 1848–'55, were productive of the most beneficial results in the development of the physiological and medical sciences, as well as in agriculture. As a consequence of this knowledge, we have to greet the successful experiments in the artificial production of organic matter or the chemical synthesis inaugurated by the French chemist Berthelot in 1856. At present a whole series of genuine

organic substances, such as alcohol, various kinds of ether, grape sugar, organic acids, fats, alkaloids, vegetable oils or perfumes, etc., are being manufactured in a purely chemical way, and the hope is well founded that in course of time we may also succeed in preparing directly from the elements sugars and albumins—yea, even the protoplasm or that organic primal substance out of which all living beings are evolving. What chemistry even now is capable of achieving is shown by the preparations made from coal tar of practicable pigments, perfumes, saccharines, and drugs.

Finally, we must mention in this place the discovery of *argon*, a hitherto unknown element of the atmospheric air, as well as the successful preparation of *acetylene* by Professor Moisson. This is a luminous gas which is sixteen times stronger than common gas, and has five times the illuminating power of Auer's gaslight.

Geology.—As we owe to the progress in chemistry the refutation of the theory of a vital principle, geology in like manner has disproved, chiefly through the labors of the gifted English geologist Lyell (1830–'33), the formerly accepted theory of great physical catastrophes or terrestrial revolutions and of separate acts of creation, and has shown that the past of the history of our globe (which in its evolutionary process advances slowly but continuously) is nothing but its unrolled present.

Paleontology.—In close connection with geology is paleontology, or the knowledge of the former life of our globe. This has been raised to the rank of a science only during the present century. Now this science has so far advanced that we can survey the gradual development of the entire organic world, and find that those transitional and intermediate forms required of the evolutionary theory are no longer missing. The vast North American plains are especially remarkable as having been found to be rich treasure houses of such forms.

Anatomy.—Closely connected with paleontology are anatomy and the discovery made in this science of the cell as the primordial element or fundamental form of the whole organic world. This discovery was made by Schwann and Schleiden in 1839, after the microscope had been brought, through the efforts of Amici, to such a perfection as to make possible by its use the more and more subtle investigation of animal tissue. Through the discovery of the cell, the unity, as to kind and origin, of everything living was demonstrated; and it was shown that even the highest and most complicated organisms were simply combinations of cells in a more or less changed condition. Then, in 1859, Virchow made an ingenious application of the cell theory to medical science. Virchow, in his *Cellular-Pathologie*, searched in the modified cell for the nature

of disease, and promulgated that doctrine, so bold for his time, "*Omnis cellula ab cellula*" (every cell from a cell)—a doctrine that will always stand like a corner stone of the temple of science. The continuity of everything living expressed by this doctrine was confirmed later on by the progress made in comparative anatomy, so that the fundamental plan common to the type of vertebrates could be traced to its last details, and it was shown that between animal and human structure the characteristic of distinction is not absolute, but only relative. Of special importance in this connection is the proof that even the organ of mind—i. e., the brain—is no exception to the general rule, and that it is built on a common fundamental plan in both man and animal.

After all, not much had been gained for a philosophical view of Nature and a natural explanation of generation, in its inception, by the discovery of the cell as the primordial form of the organic world, the cell itself being too high and complicated a formation to be regarded as rudimentary. There was therefore a hiatus in our knowledge which gave the opponents of the theory that the world is the result of a series of changes governed by natural laws a convenient ground for declaring the theory untenable and false. But this difficulty also was removed by the discovery (likewise belonging to our century) of protoplasm, or the original primordial substance, made by Max Schulze in 1863. This protoplasm, consisting of shapeless organic matter, is identical with Haeckel's celebrated *monera*, or those formless albumin lumps, those organless organisms out of which the true cell only develops after a long series of intermediate stages. And the *moner* itself, in all probability, is not the first step, but the ultimate product of previous stages of development in the process of the transformation of the inorganic into the organic. Naegeli's mechanico-physiological theory of descent goes even so far as to declare the distance between the *moner* and the true primordial plasma substance far greater that that between the *moner* and the mammal! In the light of these discoveries and the consequent conclusions, the much-ventilated question of primal generation, which formerly was covered by impenetrable darkness, no longer presents any difficulty in the way of scientific explanation.

Physiology.—In close connection with anatomy and the history of evolution, which are occupied with the physical building up of the organisms, stands physiology, or the science of the functions of the organs. Here we notice, in the first place, the great discovery made by von Baer, in 1827, of the *ovum* of the mammals and of man, in its original place in the *ovary*. This discovery was soon after followed, in 1844, by the elucidation by Th. Bischoff of the

process of fecundation and generation, which theretofore had been wrapped in the deepest obscurity. Four years later, in 1848, followed Du Bois-Reymond's researches in animal electricity and the proof that the nerve is not, as formerly believed, a mere conductor, but a self-generator of the electricity originated by chemical metabolism and the transformation of what is designated as potential force or elasticity into living force or motion by virtue of the great principle of the conservation of force.

Under the head of physiology, special mention must also be made of the great successes that accompanied the researches of Messrs. Schiff, Ferrier, Munk, Nothnagel, Hitzig, Fritsch, Broca, Flechsig, and others concerning the localization of the various activities of the soul, or the divisions of labor taking place in the brain, and the topographical distribution of certain functions of the brain on its surface—researches which have not by any means reached their end. The most important among these is the discovery, made first by Broca, in 1861, of the controlling center of speech at a definite place in the fore part of the brain. Morbid degeneration or destruction of this spot is the cause of *aphasia*, or speechlessness. This discovery also satisfactorily explains why the large manlike apes which are almost devoid of that part of the brain can not speak, notwithstanding the formation of their larynges is similar to that of man. Not less important are the entirely new researches of Professor Flechsig on the so-called centers of association in the brain and the definite proof furnished by him that all thinking springs from the senses, inasmuch as it is only by the gradual development of those centers that the action of the different organs is connected, and thus thinking and intelligence are made possible.

Zoölogy.—Besides the numerous acquisitions of systematic zoölogy, special mention should be made here of the researches as to the life in the sea. These have been prosecuted largely through the zoölogical marine stations supported by Government, and have been rendered more effective by means of improved apparatus which made possible the acquisition of knowledge as to the deep-sea fauna. The results enabled Haeckel to establish his renowned Gastræa theory, according to which all animal species—however far differentiated—owe their primal origin to a single primitive form of the greatest simplicity that might be properly designated as "primitive stomach." To the zoölogical researches of the century we are also indebted for the better knowledge of those strange animal creatures nearest to man whose existence was still doubted or relegated to the realm of fable as late as the last century even by scholars, although as early as 500 B. C. the Carthaginian Hanno had seen gorillas on the western coast of Africa, and described them as wild "haired men."

Now, the so-called anthropoids or large manlike apes may be seen either dead or alive in many museums and zoölogical gardens.

Biology.—Closely connected with zoölogy is biology, or the science of life, which undoubtedly has achieved the greatest progress made by physical science in the century by the promulgation and victory of the theory of descent by evolution, a theory brought forward by Darwin in 1860, and developed by Haeckel and others. Nearly related to it are the above-mentioned remarkable discoveries in the domain of paleontology and the knowledge of numerous intermediate forms which formerly had been disregarded as unimportant "varieties."

Archæology.—The existence of the fossil man, which had been doubted so long, has been proved, and the geological age of the human race established. The series of discoveries coming under this head was opened in the years 1830–'40 by the discovery, made by the French scientist Boucher de Perthes, of man-made diluvial flint axes in the Somme Valley in the north of France. Since then the researches concerning the age and the preliminary history of mankind have become the favorite study of the time and of scholars, and there has come into being within a comparatively short time a literature on this subject the wealth of which can hrdly be surveyed. The discoveries in this vast and interesting domain are accumulating from year to year to such an extent as to give rise to a new and successful science of archæology. While on the one hand this science teaches us that the existence of man on earth must be shifted back into hoary ages to which the historical period can not be compared at all, it shows us, on the other hand, that this period considered geologically—i. e., when compared with the periods of evolution of the earth—is of itself a very recent and new one. It is for this reason that the origin of man must be regarded as the crowning or culminating point of the whole organic evolution—a point beyond which the development of the world was no longer carried on by Nature, but by man. A highly desirable completion of these studies on the primal history of the human race was supplied by the great progress in ethnology made possible by the enormous traveling facilities of our century.

Psychology.—Closely related to anthropology is psychology, as to which the conviction prevails in authoritative circles that it should not be classed with the philosophical sciences, but with the physical; or at least that it must be treated after the physical method if any tangible result is to be attained. It was this mode of treatment that achieved the afore-mentioned result of the measurement of the duration of human thought. We owe also to this method the better knowledge of the animal soul and the foundation for com-

parative psychology, analogous to comparative anatomy, which latter has been in an advanced stage for a long time. Finally, in the psychological domain we owe to modern times the knowledge of the strange phenomena of double consciousness and of hypnotism with the phenomena of suggestion, the study of which is calculated to throw on the mental being more light than could the most voluminous works on psychology of former times, which were the result of self-observation and self-deification. Unfortunately, these phenomena have given food to the inextirpable belief in miracles, and furnished new support for unfounded spiritualistic and spiritistic chimeras of every kind, such as thought-reading, telepathy, magnetic *rapport*, the belief in ghosts, spooks, etc.

MEDICINE.—If we finally mention medicine or therapeutics as a branch of physical science we have here also to record a series of the most important advances in the course of the century. At the head stands the method of auscultation or of listening by means of an ear trumpet to the sounds in the chest in order to discover disease in the lungs and the heart. This method was invented by the French physician Laennec in 1819, soon after the method of percussion had been improved by Piorry, while the foundation of pathological anatomy through Professor Rokitansky, and of pathological histology by Professor Virchow, which soon after followed, advanced medicine to a real science. Another invention, highly important in practice—subcutaneous injection—was made by A. Wood in 1850. More recent than all this is the very important discovery of the infectious micro-organisms or bacteria as the causes of disease. This discovery, which led to the application of disinfection, in common with the introduction of chloroform and cocaine as anæsthetics, on the one hand, cleared the way for the acknowledged wonderful progress made in surgery, and, on the other hand, materially facilitated the combating of diseases caused by those organisms by prophylactic measures.

We must also allude to the invention of a great number of new remedies obtained by means of chemistry, as well as of new methods of curing ailments (e. g., massage). We must mention, too, the general introduction of vaccination, which has proved one of the greatest blessings to mankind. Whether the injection of fluids as an immunity against certain diseases (e. g., diphtheria), tried according to the same method, will fulfill the hope entertained is a question the solution of which must be awaited after the unfortunate failure of a similar procedure employed in tuberculosis. It seems, however, as though this so-called "serum therapeutics" in its further development might accomplish great results in the field of infectious diseases. The ascertaining and location of internal diseases (particu-

larly as to the skeleton) has likewise been advanced, as previously referred to, in marvelous manner by the application of the "X" or Röntgen rays to the illumination of the human body.

To the great progress in human knowledge must be added the no less gigantic advances in power accomplished by the nineteenth century, and effected by the greater knowledge and mastery of the forces of Nature. Above all must be noticed here the forces acquired by the control of steam, conquering all resistance and giving birth to those noble children of the century—railroads and steamboats. This has brought the powers of legendary giants under the commanding hand of man. A few decades have been sufficient to span the greater part of our globe with space and time annihilating messengers, and by means of the even more marvelous inventions of the telegraph and telephone to bring into direct communication with each other the most distant parts of the earth's surface. Another child of this our century is the phonograph, whose astonishing achievements remind us of fairy tales; and another is the art of photography, which, as already said, has with an unanticipated success been placed in the service of science (astronomy, telescopy, geography, and ethnography). Its instantaneous pictures have brought it about that the successive movements of a complete occurrence are separately reproduced before our wondering eyes as though we saw a repetition of the actual scene. This art, however, still awaits one of its greatest triumphs in the production of colored pictures. We must also mention the invention of dynamite, a product making practicable the exertion of unprecedented energy, and so indispensable wherever great mass effects are to be attained; and also of smokeless powder, which may prove beneficent in abating or even completely abolishing the great continental wars.

Finally, our century has witnessed the union of electric force with chemistry and technics in the form of electro-chemistry and electro-technics, which open the brightest vistas into the future. For the wonderful force of electricity excels in readiness of application and utility all other forces of Nature, and beyond any other vanquishes the checking barriers of space and time. It can, without any special means, be almost directly derived from or changed into all other forms of natural force, and proceeds with an extraordinary velocity through the prescribed paths of the conducting wires. It can, therefore, at any moment be conducted to any place where its effect is required. Dwellings are now illuminated by electricity almost everywhere, and if heating by the same agent and the cooking of food by means of it become common, then is foreshadowed an almost paradisiacal state, in place of the conditions of existence now

prevailing with their attendant trouble, uncleanliness, dust, vexation, and disease. And should electro-technics succeed—as there is well-founded hope that it will—in solving the problem of obtaining electricity direct from the fuel, instead of by an expensive indirect method as heretofore, the far-reaching effect of such success can scarcely be overestimated. As with respect to material progress this century is fittingly called the Century of Steam, so most likely the coming century will have to be designated the Century of Electricity, when the more extended control of the forces of Nature by the human mind shall have taken an immense stride in the forward direction. If we add to all this that the grand material as well as intellectual development of the great land of liberty in the far West of our globe, the like of which has never been seen before, promises to continue in the same or even a higher degree, then the men of the coming century will of necessity be more profoundly impressed than the children of the present by the achievements of human intellect and human power.

It may be that we are, with respect to the coming century, in the same immature mental condition in which the people of the eighteenth century were with regard to the nineteenth. If some one in the preceding century had dared to predict the wonderful achievements of the nineteenth, he would probably have been declared a fool, and treated as was Robert Mayer, in Germany, in this century, who, after the discovery of the law of the conservation of force, was put into an insane asylum. A like fate might befall the man who should dare now to cast a horoscope for the twentieth century, and to predict the progress of the human mind in the various domains of scientific research. After all, those may be right who, in spite of all those acquisitions on which we so justly pride ourselves, are of opinion that we are still moving in only the initial steps, in the leading strings of evolution, and that we are yet very far from the goal of those material and ideal aims which the human race in its unremitting onward struggle is destined to attain, or to show its capacity of attaining. The great Sir Isaac Newton used, perhaps, the most appropriate simile when he compared men with children who on the seashore are picking up here and there a curious pebble or colored shell while the great sea of truth lies still unexplored before them. We can only conjecture as to the probable progress, as we can not know which position we occupy in the course of human evolution, whether we are still in its beginnings or well advanced. This lies hidden in the bosom of the future. We therefore discontinue this line of thought, and remark here again that unfortunately this great progress in knowledge and power in our century has not extended to the moral, general intellectual, literary,

or social domains, and perhaps we should except also the realm of politics. To grasp and to establish the hitherto wanting but yet so necessary harmony between being and thinking will probably be the chief task of the century soon to come in.

As regards the sciences thus far not mentioned (philosophy, theology, jurisprudence), there is, to our knowledge, much movement to be noticed, but comparatively little real progress. An exception must be made as to history, which as *Kulturgeschichte* (history of civilization) has assumed a scientific character contrasting markedly with its previous form. The same is true of the history of religion, which has given a well-deserved attention to the ancient Hindu religions, especially the venerable religion of Buddha; furthermore, the successful study of antiquity, which, especially in connection with a branch of physical science or geology as archæology, has furnished the most valuable disclosures as to prehistoric times. Political economy, statistics, and hygiene also may look back on their achievements with pride. The ethics of moral science has also derived great profit from the revelations of physical sciences on the gradual acquisition and transmission through heredity of mental and moral qualities. The like can be said with even more emphasis of general philology, which happily applied the principles of the theory of evolution to the great problem of the origin of languages, and proved that the laws according to which species and languages originate, grow, and, through the extinction of intermediate links, separate from each other, are identical.

Furthermore, in all domains of human knowledge, without exception, a great number of important and valuable detail researches have been made which, in their totality, also tend to raise their respective sciences to a higher level.

M. FERDINAND BRUNETIÈRE, the distinguished French critic, who recently came to the United States to deliver a course of lectures, confesses to having met some difficulties in a search he made to find a typical American. At Baltimore, as at New York, all that he observed of original or local seemed to bear an element of cosmopolitanism. The "American" or English professor of whom he borrowed a pencil was a German. A lady whose manner, physiognomy, and language struck him as American, was of French origin. Another person of "American" manners spent half the year in Paris or Switzerland. The man who asked him how he liked Baltimore was a Russian. He found, too, Italians, Greeks, Jews, and what not, of "American" aspect and manners, and wondered when he would meet an American born in America of American parents, or who had not been subject to influences from abroad. "No," he says, "race has not in America any more than in Europe the importance that is given it."

EVOLUTIONARY ETHICS.*

By HERBERT SPENCER.

THE following letter, published in the *Athenæum* for August 5, 1893, was drawn from me in response to certain passages in the Romanes Lecture, delivered by the late Prof. Huxley at Oxford in the Spring of 1893.† These passages were supposed to be directed against doctrines I hold (see *Athenæum*, July 22, 1893); and it seemed needful that I should defend myself against an attack coming from one whose authority was so great. My justification for including this letter among these fragments is that since the Romanes Lecture referred to exists in a permanent form, it is proper that a permanent form should be given to my reply.

If it is not too great a breach of your rules, will you allow me space for some remarks suggested by the review of Prof. Huxley's lecture on "Evolution and Ethics," contained in your issue of the 22nd inst.?

The incongruity between note 19 of the series appended to the lecture, and a leading doctrine contained in the lecture itself, is rightly pointed out by your reviewer. In the lecture Prof. Huxley says:—

"The practice of that which is ethically best—what we call goodness or virtue—involves a course of conduct which, in all respects, is opposed to that which leads to success in the cosmic struggle for existence. In place of ruthless self-assertion it demands self-restraint."—P. 33.

But in note 19 he admits that—

"strictly speaking [why not rightly speaking?], social life and the ethical process, in virtue of which it advances towards perfection, are part and parcel of the general process of evolution, just as the gregarious habit of innumerable plants and animals, which has been of immense advantage to them, is so."

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* From Various Fragments, by Herbert Spencer, in press of D. Appleton and Company.

† As the Romanes Lecture was published in the Monthly (November and December, 1893), it seemed fitting that this reply to some of the more important points raised by Professor Huxley should also be given to our readers. We accordingly put the letter in type soon after it appeared in The Athenæum, but at the request of Mr. Spencer it was withdrawn. He having now given it permanent form, we feel at liberty to carry out our original intention.—THE EDITOR.

I do not see how the original assertion can survive after this admission has been made. Practically the last cancels the first. If the ethical process is a part of the process of evolution or cosmic process, then how can the two be put in opposition? Prof. Huxley says:—

"The struggle for existence, which has done such admirable work in cosmic nature, must, it appears [according to the view he opposes], be equally beneficent in the ethical sphere. Yet, if that which I have insisted upon is true; if the cosmic process has no sort of relation to moral ends; if the imitation of it by man is inconsistent with the first principles of ethics; what becomes of this surprising theory?"—P. 34.

But when we find that the hypothetical statement, "if the cosmic process has no sort of relation to moral ends," is followed by the positive statement that "the cosmic process" *has* "a sort of relation to moral ends," we may ask, "what becomes of this surjrising" criticism? Obviously, indeed, Prof. Huxley cannot avoid admitting that the ethical process, and, by implication, the ethical man, are products of the cosmic process. For if the ethical man is not a product of the cosmic process, what is he a product of?

The view of which Prof. Huxley admits the truth in note 19 is the view which I have perpetually enunciated: the difference being that instead of relegating it to an obscure note, I have made it a conspicuous component of the text. As far back as 1850, when I did not yet recognize evolution as a process co-extensive with the cosmos, but only as a process exhibited in man and in society, I contended that social progress is a result of "the ethical process," saying that—

"the ultimate man will be one whose private requirements coincide with public ones. He will be that manner of man who, in spontaneously fulfilling his own nature incidentally performs the functions of a social unit; and yet is only enabled so to fulfil his own nature, by all others doing the like."—*Social Statics*, "General Considerations."

And from that time onwards I have, in various ways, insisted upon this truth. In a chapter of the *Principles of Ethics* entitled "Altruism *versus* Egoism," it is contended that from the dawn of life altruism of a kind (parental altruism) has been as essential as egoism; and that in the associated state the function of altruism becomes wider, and the importance of it greater, in proportion as the civilization becomes higher. Moreover, I have said that—

"from the laws of life it must be concluded that unceasing social discipline will so mould human nature, that eventually sympathetic pleasures will be spontaneously pursued to the fullest extent advantageous to each and all."—*Ethics*, § 95.

"With the highest type of human life, there will come also a state in which egoism and altruism are so conciliated that the one merges in the other."—*Ib.*, appended chapter to Part I.

Everywhere it is asserted that the process of adaptation (which, in its direct and indirect forms, is a part of the cosmic process) must continuously tend (under peaceful conditions) to produce a type of society and a type of individual in which "the instincts of savagery in civilized men" will be not only "curbed," but repressed. And I believe that in few, if any, writings will be found as unceasing a denunciation of that brute form of the struggle for existence which has been going on between societies, and which, though in early times a cause of progress, is now becoming a cause of retrogression. No one has so often insisted that "the ethical process" is hindered by the cowardly conquests of bullet and shell over arrow and assegai, which demoralize the one side while slaughtering the other.

And here, while referring to the rebarbarizing effects of the struggle for existence carried on by brute force, let me say that I am glad to have Prof. Huxley's endorsement of the proposition that the survival of the fittest is not always the survival of the best. Twenty years ago, in an essay entitled "Mr. Martineau on Evolution," I pointed out that "the fittest" throughout a wide range of cases—perhaps the widest range—are not the "best"; and said that I had chosen the expression "survival of the fittest" rather than survival of the best because the latter phrase did not cover the facts.

Chiefly, however, I wish to point out the radical misconceptions which are current concerning that form of evolutionary ethics with which I am identified. In the preface to *The Data of Ethics*, when first published separately, I remarked that by treating the whole subject in parts, which would by many be read as though they were wholes, I had "given abundant opportunity for misrepresentation." The opportunity has not been lost. The division treating of "Justice" has been habitually spoken of as though nothing more was intended to be said; and this notwithstanding warnings which the division itself contains, as in § 257, and again in § 270; where it is said that "other injunctions which ethics has to utter do not here concern us . . . there are the demands and restraints included under Negative Beneficence and Positive Beneficence, to be hereafter

treated of." Even if considered apart, however, the doctrine set forth in this division has no such interpretation as that perversely put upon it. It is represented as nothing but an assertion of the claims of the individual to what benefits he can gain in the struggle for existence; whereas it is in far larger measure a specification of the equitable limits to his activities, and of the restraints which must be imposed on him. I am not aware that any one has more emphatically asserted that society in its corporate capacity must exercise a rigorous control over its individual members, to the extent needful for preventing trespasses one upon another. No one has more frequently or strongly denounced governments for the laxity with which they fulfil this duty. So far from being, as some have alleged, an advocacy of the claims of the strong against the weak, it is much more an insistence that the weak shall be guarded against the strong, so that they may suffer no greater evils than their relative weakness itself involves. And no one has more vehemently condemned that "miserable *laissez-faire* which calmly looks on while men ruin themselves in trying to enforce by law their equitable claims" (*Ethics*, § 271).

Now that the remaining parts, treating of Beneficence, have been added to the rest, the perverse misinterpretation continues in face of direct disproofs. At the very outset of the *Ethics* it is said:—

"There remains a further advance not yet even hinted. For beyond so behaving that each achieves his ends without preventing others from achieving their ends, the members of a society may give mutual help in the achievement of ends."—§ 6.

And in a subsequent chapter it is said that

"the limit of evolution of conduct is consequently not reached until, beyond avoidance of direct and indirect injuries to others, there are spontaneous efforts to further the welfare of others." "It may be shown that the form of nature which thus to justice adds beneficence, is one which adaptation to the social state produces."—§ 54.

These are texts which in Parts V. and VI., dealing with Beneficence, Negative and Positive, are fully expanded. Having first distinguished between "kinds of altruism," and contended that the kind we call justice has to be enforced by the incorporated society, the State, while the kind we call beneficence must be left to individuals, and after pointing out the grave evils which result if this distinction is not maintained, I have described in detail the limits to men's actions which negative beneficence enjoins. Then come two chapters, entitled "Restraints on Free Competition" and "Restraints on

Free Contract," respectively indicating various cases in which the restraints imposed by law must be supplemented by self-restraints, and instancing one of the excesses committed under free competition as amounting to "commercial murder." Chapters enjoining further self-restraints for the benefit of others are followed, in the division on Positive Beneficence, by chapters enjoining efforts on their behalf, and the duty which falls on the superior of mitigating the evils which the inferior have to bear. After dealing, in a chapter on "Relief of the Poor," with the evils often caused by attempts to diminish distress, it is contended that philanthropic duty should be performed not by proxy, but directly; and that each person of means ought to see to the welfare of the particular cluster of inferiors with whom his circumstances put him in relation. The general nature of the doctrine set forth may be inferred from two sentences in the closing chapter:—

"The highest beneficence is that which is not only prepared, if need be, to sacrifice egoistic pleasures, but is also prepared, if need be, to sacrifice altruistic pleasures."—§ 474.

And then, speaking of the natures which "the ethical process" is in course of producing, it is said that

"in such natures a large part of the mental life must result from participation in the mental lives of others."—§ 475.

I do not see how there could be expressed ideas more diametrically opposed to that brutal individualism which some persons ascribe to me.

It remains only to say that Prof. Huxley's attack upon the doctrines of Ravachol & Co. has my hearty approval, though I do not quite see the need for it. Evidently it is intended for the extreme anarchists; or, at least, I know of no others against whom his arguments tell. It has been absurdly supposed that his lecture was, in part, an indirect criticism upon theories held by me. But this cannot be. It is scarcely supposable that he deliberately undertook to teach me my own doctrines, enunciated some of them forty-odd years ago. Passing over the historical and metaphysical parts of his lecture, his theses are those for which I have always contended. We agree that the process of evolution must reach a limit, after which a reverse change must begin (*First Principles*, chaps. "Equilibration" and "Dissolution"). We agree that the survival of the fittest is often not survival of the best. We agree in denouncing the brutal form of the struggle for existence. We agree that the ethical

process is a part of the process of evolution. We agree that the struggle for life needs to be qualified when the gregarious state is entered, and that among gregarious creatures lower than man a rudiment of the ethical check is visible. We agree that among men the ethical check, becoming more and more peremptory, has to be enforced by the society in its corporate capacity, the State. We agree that beyond that qualification of the struggle for life which consists in restricting the activities of each so that he may not trench upon the spheres for the like activities of others, which we call justice, there needs that further qualification which we call beneficence; and we differ only respecting the agency by which the beneficence should be exercised. We agree in emphasizing, as a duty, the effort to mitigate the evils which the struggle for existence in the social state entails; and how complete is this agreement may be seen on observing that the sentiment contained in Prof. Huxley's closing lines is identical with the sentiment contained in the last paragraph of the *Principles of Ethics*. Obviously, then, it is impossible that Prof. Huxley can have meant to place the ethical views he holds in opposition to the ethical views I hold; and it is the more obviously impossible because, for a fortnight before his lecture, Prof. Huxley had in his hands the volumes containing the above quotations, along with multitudinous passages of kindred meanings. But as this erroneous belief is prevalent, it seems needful for me to dissipate it. Hence this letter.

The closing lines of this last paragraph were regarded by Prof. Huxley as tacitly charging him with an unacknowledged adoption of my views. It did not occur to me when writing them that they could be so interpreted. My intention was simply to show that he had abundant opportunity for seeing at first hand what my views were, and had therefore the less reason for presenting his own similar views as though they stood in opposition to mine.

As an example of the work that may be done for scientific geography in Africa, Mr. J. Scott Keltie cited, in the British Association, the discovery made by Mr. Moore, a young biologist trained in geographical observation, on Lake Tanganyika, of a fauna held to be of a salt-water type, which seems to afford a key to the past history of the center of the continent. Mr. Moore believes that the connection of this part of Africa with the coast was not by the west, as Joseph Thomson surmised, but by the north, through the Great Rift Valley of Dr. Gregory.

PRINCIPLES OF TAXATION.

By DAVID A. WELLS, LL.D., D.C.L.,
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XV.—WHAT IS PROPERTY?

ONE of the greatest obstacles in the way of framing a correct system of general taxation, is the different and wholly antagonistic opinions that popularly prevail, as to the real nature of what constitutes its chief objective in respect to administrative action, namely, "property." This point finds full confirmation and illustration by reference to the several definitions that have been given to this term by various recognized authorities, and have been accepted to a greater or less extent as authoritative by a general and even educated public. Thus, as before noted, a widely accepted definition of Professors Macleod, Perry, and others is, that everything that can be bought or sold is property. Thus, even the random ideas of an anarchist are a form of wealth at present, just as the "*goaks*" of Artemus Ward used to be—because they have exchangeable value, and will bring a certain number of dollars to him, or to the reporter or interviewer who gives his notions to the public. So the beauty of an actress, the nimble legs of a dancer, the vocal sweetness of an opera singer, are also forms of wealth, since they have an exchangeable value when utilized. And hence the folly of the socialists, who suppose that by dividing property, or equalizing the distribution of land, they can secure equality of wealth, since diversities of human faculty and opportunities would instantly begin to make this imperfect distribution more unequal than before. Thus the Greek philosopher Aristotle, speaking of the division of land among all the citizens of his time, has the credit of shrewdly saying, "Either all kinds of property must be equalized, or all must be let alone." According to Webster's Dictionary, that "to which one has a legal title" is property. And in a report of a recent lecture, a leading American theologian is credited with saying to an assemblage of divinity students that "he adopted as the basis of his discussion of property the 'profound and perfect' definition of the Roman Catholic theologian Brownson, namely, that 'property is communion with God through the material.' And to realize and apply this definition is the great duty of the Christian teacher."

"The term property denotes a right over a determinative *thing*. Property is the right of any person to possess, use, enjoy, and dispose of a thing."—*Eaton vs. Boston, 51 N. H., 504.*

A more rational conception of the exact nature of property, or rather of what property consists, would, however, seem to lead to

this conclusion, namely, that property, at least for the purpose of taxation, is always a *physical actuality, with inhering rights or titles, the product solely of labor, and is always measured in respect to value and for exchange by labor.*

Thus, for example, a fish *free in the ocean* is not property; but when it has been caught through the instrumentality of labor it becomes property. Property, furthermore, can not be created except by an application of labor of some kind to material substances, which because they are substances and in order to be substances must have both a *corpus*, or an entity, and a *situs*, or a situation. Human labor incorporated in things, and thus saved to those who acquire the things, is also what constitutes value or capital; and nothing can be capital but the existing results of previous labor, which can contribute to man's enjoyment and well-being.

It is interesting also to note in this connection how the etymology of the Latin words *possessus* and *possideo*, namely, *po* and *sideo*, to *sit by* or *on*, and from which in turn we have the English word *possession*—the common definition of property being something possessed—curiously harmonize with and confirm the conclusion that property must be always a physical actuality. For it is clear that it is only a material something, a visible and tangible entity, that one can sit down on, and not an invisible, intangible nothing, the fiction of law or of the imagination.

A limitation, little recognized by legal writers and authorities, on the exercise of the right of *eminent domain* (the name given to the power inherent in state sovereignty of making a compulsory purchase of private property for public use), also sustains the correctness of the definition of property as above given; inasmuch as this right is never conceded or made applicable to other than an *actuality*, and never to a mere representative of something that is not material. Thus one of the illustrations of Roman jurisprudence handed down by Tacitus was to the effect that an emperor was not allowed to appropriate the right to carry a stream of water through the lands of a private individual, but did pay damages for the injuries thereby accruing to the lands.

All investigation on this subject can therefore, it is believed, lead to but one conclusion, and that is that *property is always "embodied or accumulated labor."* And as political economy does not, and jurisprudence ought not to take cognizance of *châteaux en Espagne*, these are the only senses in which political economy and the law can legitimately reason about property.*

* The statement is frequently made that all value is the product of labor. Adam Smith says, "Labor is the fund which originally supplies a nation with its wealth." McCulloch says, "Labor is the only source of wealth"; and all the early writers, in one form or

Examples of property which is apparently not the result of accumulated or of any labor, and so militating against these conclusions, will doubtless suggest themselves: such, for instance, as a diamond found upon the seashore, land squatted upon and obtained by preemption, bank stock, patent rights, copyrights, anuities obtained by gift or purchase, franchises, monopolies, and debts; but an examination will soon prove that the objections embodied in them are more specious than real. Thus, in the case of the diamond accidentally picked up, which is perhaps one of the most striking of all the examples that can be adduced in favor of the position that property can come into existence without the agency of labor, it may be said: first, that an exceptional fact like this can not constitute an adequate basis for the enunciation of a principle; and, next, that the value of this accidental diamond is solely determined by and represents the value of the labor which has been required to obtain all other existing diamonds. The moment the fact ceases to be exceptional, the moment diamonds can be had in abundance by merely picking them up, that moment their value will simply represent the cost of the physical effort requisite to pick them up. Again, if land squatted upon has any value as property whatever in the first instance, it is because it is the embodiment of the labor required to discover it, to conquer it, to defend and protect it; to effect all of which, taxes, which are the results of labor, may have been paid for centuries. If it acquires any additional value beyond this, after it has been

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another, say the same thing. Accepting under such circumstances an entire misconception of the true meaning of the word *labor*, the popular mind has been drawn to the conclusion that hand labor or muscular exertion is the producer of all value; and has added the corollary that hand labor is therefore entitled to the entire value thus produced. But when closely examined, the true meaning of the word labor will be found to be, *all that a man can do, either with his muscle or his brain.* On this crude misconception of the meaning of words, philanthropic systems have grown up, under which the weaker ones have lost heart, and the stronger ones have grown desperate, because the hard sense of humanity does not accept their theories. Also, through their influence, these ideas have reacted and are reacting on the laborers themselves, with rather lamentable results. Thus it is a very general complaint of the present time that the ordinary workman, the person commonly understood by the word "laborer," puts so little mind into his or her work that it is perfunctory to the last degree; concerns itself very little with results, but expends its efforts in a function whose sole end is to escape blame or actual discharge, and to get along with the least possible exertion; when the fact is, that the three functions of capital (which is accumulated labor), labor (in the muscular sense), and management (or brain power) must as a rule act conjointly, in order to insure the best results. "In more recent times, a truer appreciation of this word has arisen, but even yet has not been so absorbed into the general fund of knowledge as to bear practical fruits; and it needs to be constantly dwelt upon, set forth, reiterated, and explained, until it shall become a common possession of those who think." The reason why more attention has not been given to this subject by the earlier economists has been assigned to the fact that they drew their illustrations from a very primitive life, where the bow and spear figured prominently.—*Address, American Social Science Association, 1893, by F. J. Kingsbury, LL. D.*

squatted upon, it will be simply because the results of labor have become connected with it, or the value of other land or other property the products of labor, for the use of which labor competes, are reflected upon it. In 1620 the land upon which the city of Boston stands could have been bought for a string of sea shells; in 1894 its value for assessment as property for taxation was probably in excess of $900,000,000. But in both instances the valuation was determined by one and the same standard: in the first, by the amount of labor required to collect and string the shells; and in the second, by the amount of labor and capital—which is the result of labor—which has been embodied in the land or become connected with it. Take away the labor and its accumulated results, and the site of Boston will be worth no more at the present time than it was in 1628, when William Blackstone first obtained it.

Analyze next the alleged property in bank notes. The coin in the vaults of the bank, the vaults, the building, the books, the furniture, and other physical actualities—the results of labor—employed in transacting the business of banking, are the real property of the bank. The bank stock, so long as the bank exists, is merely a right to receive dividends. The creation of a bank obviously does not create any property. The notes discounted by the bank over its counter are inchoate titles to the debtor's property or to his rights to property; and the notes issued by the bank are inchoate titles to the bank's property or to its equitable rights to property. The bank, apart from its physical actualities and machinery, is simply a ledger recording credits and debits. But credits and debits are only convenient forms of bookkeeping, or the records of transfers of property and of rights, titles, and interests in property pre-existing. Credits and debits, moreover, stand to each other in the relation of an equation. There can be no credit without a debit, and no debit without a credit; strike out one side of the equation, and the other disappears of necessity. If there were no creditors there could be no debtors, and, *vice versa*, the moment debtors cease to be debtors, that same moment creditors cease to be creditors.*

Copyrights and *patents* are simply legislative enactments to protect pre-existing property. A manuscript, a painting, or an invention is the joint product of physical and intellectual labor, which the copyright or patent right protects, the same as other forms of law protect other visible and tangible property from robbery and spoliation. The relation which these instrumentalities sustain to property is clearly indicated by asking the question, whether there can be such a thing as a patent granted for what has never been reduced to

* The Supreme Court of Alabama has recently decided that when a bank in that State owns real estate the same is not liable to taxation as a part of its capital stock.

a physical actuality; or a copyright given for the flight of fancy of a poet not embodied in the materiality of a manuscript or in the pages of a printed book. John Milton sold Paradise Lost to Samuel Simmons, bookseller, for *five* pounds ready money; but Gray's "mute, inglorious Miltons," who only imagined and never wrote, could never have obtained a copyright or any money offer whatever—no, not even reputation—for their imaginings, though for all that the world knows they might have been infinitely superior to the Milton who became glorious because he was not mute, in all that relates to mental attainment.

"A person can read from a book, can quote from it, use its ideas in speaking and writing, and even attempt to pass them off as his own, and he will find no legal obstacle to such action. But the moment he tries to duplicate the material form in which the ideas appeared, that moment he passes from the realm of the intangible to that of the tangible"; for the book, which is the concrete thing in which the author has embodied his ideas, is an *entity*, and because an entity representing embodied labor is property which the law will protect to the owner, and can also legitimately tax, if it will. There have been repeated decisions by the courts * that there can be no property in ideas—until, for example, an author through a copyright, or an inventor through a patent, has put his ideas in such tangible form that the Government can put its stamp upon them.

It is also exceedingly curious to note how Shakespeare, whose range and accuracy of knowledge were so wonderful, clearly perceived, and as clearly expressed, the whole essence of modern political economy and jurisprudence in respect to this immediate problem, when, in the following lines from A Midsummer-Night's Dream, he says:

> "The poet's eye, in a fine frenzy rolling,
> Doth glance from heaven to earth, from earth to heaven,
> And, as imagination bodies forth
> The forms of things unknown, the poet's pen
> Turns them to shapes, and gives to airy nothing
> A local habitation and a name."

* Some years since an action was brought in a United States court by one Kortenhaus against the American Watch Company, of Waltham, Mass., to recover royalties on an improvement in stem-winding watches that he made, and which, he averred, the defendants had put to use without his consent and without awarding him any compensation therefor. The plaintiff swore that he had submitted his invention to the company's inspection with the view of selling it, but it refused to purchase, and he discovered afterward that the company had adopted the improvement, and that he had made the mistake of not patenting it. The court dismissed the action, and ruled that there was no right of property in an idea as an idea, and that it could only be made property by letters patent. Had, however, a patent been secured upon the improvement, its value as property would have been undoubtedly very considerable.

In other words, according to Shakespeare, as well as according to political economy and common sense, however brilliant may be the imagination of the poet or inventor, he has no property in his ideas or imaginings until he has reduced them through labor to an actuality. And then the value of the actuality produced for the purpose of exchange or sale, provided there is a copyright or a patent to prevent use without compensation, will be just in proportion to the effectiveness or desirability of the labor exerted upon or embodied in it. The standard for measuring the value of the work of a Shakespeare, a James Watt, and a street sweeper is one and the same.

Again, an annuity, like a bank stock, is a right to receive property, the result of previously accumulated labor, and its transfer by sale or bequest is simply a transfer of an equitable right; and a right of this character, in turn, is not property, but a title to pre-existing property. So, also, in respect to *franchises*, which, although often spoken of and regarded as property, are clearly nothing but rights. Thus, for example, a franchise of a railroad is simply a right to operate a road in a particular manner; and a legislature can not and does not create a railroad by creating or granting a franchise. At the same time, the value of a physical actuality may undoubtedly be increased by a franchise which gives a right to use such actuality in a particular way. A monopoly, also, like a franchise, is valuable, but its value consists in the fact that it gives to certain persons privileges that are taken from others, and the making of a monopoly no more creates property than does the making of a franchise.

Some persons, whose opinions are worthy of respect, have raised a point in discussing this question, that there is a distinction to be recognized between property and capital; and that both in law and political economy the latter does not necessarily conform to the definition that has been here given to the former. But can there be such a thing as capital which does not represent a physical actuality in the sense of embodied labor? Capital is the interest of a person in embodied labor over and above his debts, or his interest in legal or equitable rights to embodied labor, and can have no value, and is merely imaginary, except it has the right, title, or power to command embodied labor, or to exercise dominion over property the result of labor. All that we labor and toil for is embodied labor. We will not give our labor for the "baseless fabric of a vision," or our accumulated labor for the dreamy creations of a Berkeley or the imaginary castles of poets, except so far as they make them manifest in material forms or writings.

By some, also, the forces of Nature are regarded as property; but

they are not so until dominated over and subjugated by man; and then only do they acquire value and become negotiable and subject to proprietorship. Gravity and electricity, as free forces, are incapable of sale and taxation; nor can they, in any rational view, be considered as property. According to recent decisions of the courts of the United States, electricity is not a manufactured product, and electric-light plants do not manufacture it, but only distribute it.

WHAT ARE TITLES TO PROPERTY?—But while political economy recognizes nothing as property except physical actualities, the law, for the sake of convenience, has so long treated titles as conveying the same ideas as property, that the profession and the public have very generally come to regard the two as equivalent or identical. Consideration is, therefore, next asked to this point.

Property being embodied and accumulated labor, it becomes endowed, in all places where the rights of labor are recognized, with the attributes and incidents of titles or evidence of just ownership or possession—inchoate, legal, or equitable—which inhere in the property, follow it, and form a component part of it wherever found. The fact that the ownership, interest, or title of a non-resident, as, for example, a bond and mortgage title to his debtor's property in another state or country, can be extinguished in the real and personal property of the debtor, by attachment or other process of law in the state where the debtor resides, and where his visible, tangible property has a *situs*, also leads up to and establishes as a principle of law *that titles or incumbrances are connected with the owner, but inhere in the property, where the property is actually situated, as incidents, form a part and are inseparable from it, and include the equitable title or right of the creditor in the debtor's unsold and unincumbered property, but are not themselves property.* Some economists befog themselves on this subject, as before shown, by first defining property as anything that can be bought and sold, and then, since a title—as, for example, a deed—can be bought and sold, accept the inference that a title is necessarily property. But let us analyze this definition and assumption. The creditor can, without doubt, sell and deliver a deed to a farm, but what is sold in such instances is the farm, including a right—namely, a right to have dominion over it. But it may be rejoined that a right of dominion is property. Let us, therefore, carry the analysis a little further. If a farm in California is property in the State where it is and where it is taxed, any right or title to the same farm, held in New York or England, be it in the nature of a deed, a mortgage, a partnership interest, or any other form of title, can not be the property; for the same thing certainly can not be property in two separate States and jurisdictions, and in two distinct forms and manifestations, at the

same time. On the other hand, if it be assumed that the title to the farm is the property, and, as such, can be rightfully taxed where it (the title) is, then it stands to reason that the subject of the title, the farm in California, ought not to be also regarded as property and taxed in New York or England. In other words, if the title to the farm is property, then the farm is not really in California at all (unless the owner of the title resides there), but goes out of that State in the pocket of the individual who walks off with the title to it. We have all heard of such a concentration of meat that all that is valuable in an ox for food can be put into a quart can; but such a concentration of property as is here supposed is something much more remarkable; and admits of a man having a drove of oxen in his hand, ten acres of woodland in his hat, a church with a steeple in one coat pocket, and a four-story brick block and a mill privilege in the other.

To the Reader.—As the promulgation of ideas that are not in harmony with long-accepted lines of thought generally provokes controversy and expressions of dissent, which in turn often result in promoting self-education, the author, with a view of furthering such a result, would here ask attention to two letters, voluntarily written, when his views respecting the relations of titles to property were originally advanced by him (some years since) as a contribution to economic science; the *first* written by an eminent professor in one of the leading colleges of New England; and the *second* by an eminent merchant of New York, whose knowledge of economics was mainly the result of a long experience in practical business and financial transactions of great magnitude.

No. 1. "My Dear Mr. Wells:

"You are misled by the term titles, and are not only wrong, but, what is worse, are wrong in a superficial way.

"The real question relates to the nature of credit.

"I buy a piece of land for five hundred dollars and give my simple note for value received. The title to my land is my deed. My note has thereafter no connection whatsoever with the land, but it has value nevertheless. The bank buys it as a piece of property and holds it till maturity for the sake of the difference between its face and its price—i. e., for the discount. Your philosophy does not account for this proceeding; mine does.

"Your assertion is that things of value must have a 'physical quality.' I deny that utterly; *nothing* has value by means of a mere physical quality. Does not my annual service to the college have a value? I get, at any rate, twenty-five hundred dollars a year for it. I render no 'physical quality' whatsoever.

"My note is worth nearly or quite five hundred dollars, but it is not a title to anything; it is a claim *on me*. So are all credits—claims merely, not titles at all.

"You say if such things are value we might multiply values indefinitely. No; because we can not sell them indefinitely. So far as we can sell we make values. Even land and merchandise won't sell notes, with all their physical quality. Physical quality has nothing to do with it. The only possible test of property is sale. The reason why credits are more limited in their use than commodities and services is simply that they relate to *future time*, which is less certain than past and present time.

"Yours truly, —— ——."

With a desire to obtain an opinion on this interesting economic question from the merchant, the foregoing note was referred to his consideration by permission, and elicited from him the following rejoinder:

No. 2. "Professor —— seems to ignore the fact that debtors hold all their property which is not mortgaged or incumbered, as trustees to pay their creditors generally, and it is this same principle which gives value to unsecured credits.

"But the professor says, 'So far as we can sell we make values.' Does he mean that a counterfeit which is so good that it can be sold is a creation of value? Would a credit sell at all if it was not an inchoate right to the unsold and unincumbered property of the debtor? Of what value is a claim on a man if the claimant has no rights on the debtor's property? Such a claim would be no better than a claim on the northeast wind."

It is also important to note that while a deed to realty, properly executed and recorded, is regarded as the highest form of title, we have the decision of the United States Supreme Court (Fletcher *vs.* Peck, 6 Cranch, 87) that a deed is but an "executed contract" on the part of the grantor, not to resume the right in the thing granted; and if, therefore, a State can tax extraterritorial contracts, it may tax her citizens on deeds of land in other States.

This analysis of the meaning of property, from both an economic and legal point of view might be prosecuted with interest and profit to a much greater extent; but from what has been presented it would seem clear that nothing can not be something; or, in other words, that *property is always a physical actuality*, which has become valuable or property by some form of labor, and can not be created by mere paper documents, except to the extent of the value of the paper and the writing or printing upon it. Or, in other words, a title to property, a representative of property, can no more be property than a shadow can be a substance: and if this conclusion be true, then it would seem to follow, of necessity, that the act of making debts, bonds, verbal or written contracts, notes, book accounts, mortgages, warehouse receipts, titles, certificates of stock, or any form of salable or transferable rights, is not a creation or production of any new property, but simply an exchange, by contract or operation of law, of the rights and titles of parties in pre-existing property; and that any tax on any of these rights or titles is only another form of burdening the property which is the subject of the rights or titles. But some, in answer to the assertion that rights, debts, and titles are not property, for if they were we might make property by making rights and titles, might reply, "But we do make property in that way every day." But we can not do this indefinitely because we can not sell the title indefinitely; and why not? Let us, therefore, stop and think about it, and ask ourselves why we can not sell titles and credits indefinitely. We can sell property in the sense of embodied labor indefinitely. Why not titles and credits? The answer is simply that when we buy a title or credit we pay for and in a legal and economic effect buy the physical actuality, or right of dominion over it, which the credit or title represents, and nothing more. The moment one undertakes to sell titles

or credits in excess of or separate from the embodied labor they are supposed to represent, we call the act swindling. Fancy a member of the legal profession appearing in court to defend such a person for selling a title, separate from an actuality, on the ground that such a title was property because he was able to sell it, and that somebody not keen was persuaded to buy it! Would the plea *caveat emptor* avail in such a transaction?

In other words, when the title does *not* inhere in the physical actuality, we give it a bad name, and the most imaginative do not call it property. A title which is really a title is never suspended or in abeyance. If a thing is embodied labor, some one, or a number of persons, has some form of title or dominion over it, and the title is inseparably allied to the thing; and therefore the sale of the title is the sale of the thing, because they are one and inseparable. Embodied labor, therefore, embodies all forms of title to the embodied labor. Credits and titles of themselves have no value, and separated from the things they represent, they can not honestly be sold at all. Who will buy them? We know the character of the men who will sell them, and their representatives will always be found in penal institutions.

If some other name be given to embodied labor than *property*, it will not diminish its power to satisfy human wants; and if, on the other hand, we call credits and titles property, they can not be eaten, or made of themselves in any form to satisfy wants, but they can represent things which will satisfy wants. It is interesting also to note that when attempts have been made to claim salvage for the recovery of bills of exchange, or other titles of property, from wrecks, the courts have decided that salvage in such cases is not allowable; and, therefore, have practically held that credits and titles are not property, but mere rights to property, and in the case of negotiable instruments, when destroyed by fire or otherwise, the right under the destroyed instrument still remains, and can be enforced in courts when identified.

ACTUALITIES, NOT FICTIONS, THE LEGITIMATE SUBJECT OF TAXATION.—Enact such laws, also, in respect to taxing titles as we may, experience will prove that taxes can not be practically levied on imaginary things, or legal fictions, because it is some physical actuality, in the sense of embodied labor, that must, after all, and in the end, pay all taxes. Also, "taxes are generally demanded in money, and any tax law will be understood to require money when a different intent is not expressed" (Judge T. M. Cooley). If legislatures have the power of creating *fiat* property—that is, imaginary or fictitious property—it is beyond their power to make it pay taxes, for nothing less than omnipotence can make something out of nothing.

On the other hand, let us consider for a moment the converse of this proposition—namely, *that titles are property, and, as such, ought not to be exempt from taxation.* If this is so, then it would seem to follow that, by making titles, we can make property; and that when a man mortgages his farm for ten thousand dollars, the community have ten thousand dollars' worth of real estate and ten thousand dollars' worth of personal property, where, before the execution of the mortgage, there was only the specified value of the real estate. On the other hand, when the mortgage is paid off, ten thousand dollars' worth of personal property is destroyed, and by a parity of reasoning the State must be to that extent the poorer. A clear comprehension, then, of the facts, that property is embodied labor; that property can alone suffice to pay taxes; that rights, titles, and credits are but the representatives of property; and that, having subjected the property to taxation, there is no sense or equity in again assessing its representative, will at once divest the problem of taxation from many embarrassments which now seem to invest it, greatly simplify it, and go far toward the determination of sound and fixed tax principles.

Important decisions touching the question here under consideration that have recently been rendered by courts of high repute are also here worthy of notice. Thus, in California, the Supreme Court of the State has had before it the vexed question of taxation of mortgages, and the judges have decided, in accordance with justice and common sense, that, as mortgages do not in any way increase the body of wealth in a community, any tax laid upon them is laid upon a fictitious value; is in so far an imposition upon the taxpayer, and, inasmuch as it represents a second tax on real estate already taxed in the hands of the owner, is "double" taxation within the meaning of that term in the Constitution of California and other States.

In 1875 the following case came before the Supreme Court of New York (General Term) under the following circumstances: The administrators of a citizen being taxed by the proper tax authorities of the State for a large amount of personal property, put in a schedule of personal assets consisting mainly of certificates of stock in various railroad and mining companies, with a plea for abatement. The court, after consideration, through Noah Davis, P. J., rendered the following decision: "We are of the opinion also that the commissioners erred in including in their assessment the stocks of corporations created by and under the laws of other States. Such corporations are taxable, and we must presume, in the absence of proof, that taxes in their respective home States are duly assessed and collected upon their capital stock or property. The stocks in

such corporations, held by individuals here, are simply representatives of capital or property employed in business in other States, the title of which is vested in and controlled by the artificial person created by and residing in such States. They represent an interest which is or may become a membership in the corporation and evidence of a right to participate in divided profits and in the ultimate dividend of surplus after the payment of debts and obligations of the corporation. The stock certificates are not themselves the property, but are evidences of the rights just mentioned; to be possessed, enjoyed, and enforced under and in conformity with the laws of the State which created the body corporate."

The views thus expressed respecting the inconsistency and undesirability of directly taxing titles, credits, obligations of indebtedness, and instrumentalities of exchange are so generally and thoroughly accepted by the statesmen, financiers, and economists of Europe, that no recognition of this form of taxation can, it is believed, be found in any of their fiscal systems. In England the very idea would be scouted; and in France, where the need of great revenues is most imperative, and resort has been had to almost every other device and expedient for collecting contributions from its people, the taxation of titles and credits has never been contemplated. Some years since (1879), when the State of California adopted a new Constitution, and, in virtue of the statutes subsequently enacted under it, made subject to additional taxation bonds, moneys, promissory notes, certificates of indebtedness, and shares of stock in corporations otherwise taxed, the utter absurdity of such action was thus strikingly demonstrated in one of the San Francisco papers by the following humorous illustrations:

"A has a horse; B has nothing, but is honest and industrious. B buys A's horse and gives his promissory note for one hundred dollars. The horse previously taxed as property in A's hands is now taxed as property in B's hands, and A is taxed—just as much as he was before—on B's note, which is property also. That is to say, the new Constitution holds that by a mere stroke of his pen, B, who has nothing, and can give himself nothing, can instantaneously create as much property for others as others may happen to think that he will some day be able to acquire. Truly the performance of the man who causes two trees to grow where but one grew before is of so little comparative benefit that he might be justly censured for a sin of omission.

"Let us suppose that B had given not a written but an oral promise. Ought not A to be taxed on that? If not, *why* not? Because an oral promise is not an evidence of debt? not a 'credit?'* But how if there were witnesses? Oral promises *are* credits, however; nay, even implied promises are. You have to pay—the courts will make you pay—your tradesman's account whether you have ever passed your word or not.

* Promises, according to Professor McLeod, are property.

"Now a 'credit,' be it promissory note, mortgage, certificate of deposit, or what you will, is not only not property, but is proof that the holder has parted with property that he once had. His paper credits, which merely certify that in consideration of certain advantages (interest, freedom from cares of management, etc.) he has surrendered his property to another, have no function but that of enabling him at some future time not to resume his own, for it is no longer his, but to acquire its equivalent from the present owner. The more a man has of these things, which it is proposed to tax as property, the poorer he is—not necessarily poorer than a man with none, but poorer than himself was before he got them. It is only by surrendering them that he can become again as wealthy as he was.

"Is he then to escape taxation, living at his ease on his interest, while the man who pays it bears the expense of government for both? Let us see if under the present system the latter does anything of the kind. X wants a thousand dollars of Z, for which he can afford to pay, say, sixty dollars a year. But if the State government is going to exact from him ten dollars, he can afford to give Z but fifty, with which that person must be content, or X will either get the money from another or not take it at all. It is clear, therefore, that the lender really pays the tax, the borrower being unaffected directly; what he pays to the State he would otherwise have to pay to the lender. Indirectly he is affected thus: Taxation of the principal, by reducing the interest, reduces also the volume of borrowable money by driving a part of it into more profitable investment, and the scarcity so created tends to restore the rate of interest, the cause thus counteracting its own effect, as the slackening in the speed of a steam engine is the agent that increases its velocity.

"Reverting to the matter of the horse, we find that quadruped in the possession of B and a note for one hundred dollars in the hands of A. Relying on B's payment of the note, A purchases a hundred dollars' worth of flour from C, giving *his* note. C knows that A is good for the amount, and gives his own note for a hundred dollars for a barrel of whisky to D, who then feels rich enough to purchase a thousand cigars, at ten dollars a hundred, from E, satisfying him with a note. At the end of a month D's hospitable friends have burned all that gentleman's cigars; C, in one protracted, solitary revel, has gone through his barrel of whisky like a rat through a water pipe; A's family and retainers have consumed his flour like a flame in flax; and B's charger, broken by the weight of the financial superstructure reared upon his patient person, lies deadwise on the plain, with daisies at his head and at his feet. But he has left a legacy of taxable 'solvent credits' that does honor to his memory better than a monument of brass, and

"'Nothing beside remains round that colossal wreck!'

"Working for a dead horse is, however, proverbially disheartening, and it is some years before B has put by enough money to discharge his debt to A, and has thereby rendered him unable to pay C, whose habit of being supinely drunk has made the expensively befriended D whistle in vain for the wherewithal to pay E. But finally B hands a hundred dollars to A, who hands it to C, who hands it to D, who hands it to E; and four hundred dollars' worth of taxable property, on which the government of this State had been living, like St. Simon Stylites on his capital, vanishes into

thin air; for the notes go to the kitchen stove, and the new Constitution made no provision for taxing the ashes.

"Charles Young takes a pig in payment for his paper—like for like. Being a Jew, Mr. Young has conscientious scruples against eating pork, so he sells his pig to a butcher, taking his note. The butcher, finding the animal more than usually intelligent, thinks it would be wrong to hide the light of its political sagacity under a bushel of salt, and sells it alive to Clitus Barbour to represent that statesman, who helped to launch the new Constitution. Clitus gives his note for the pig. Becoming jealous of its rivalry, he sells it to Governor Kearney (taking his note), whose parlor it graces for a season, but, being detected in an indiscretion, the Governor sells it to General Howard, who gives his note. General Howard wants this pig to write letters favoring the new Constitution; but, as it scorns to prostitute its intellect that way, its less scrupulous owner parts with it to the congregation of Metropolitan Temple, whose pulpit it now fills, they giving their note and a benediction.

"The foregoing pig is now represented by five promissory notes and a benediction not taxed. None of these notes bear interest, nor are they of any benefit to their holders except as they may enable them, at a stated time, to get something of the same value as something previously renounced. The various notes make a trail of papers like that left by the 'hare' in the boys' game of 'hare and hounds.' Now comes the assessor under the new Constitution, and, in obedience to a righteous provision taxing property used for religious purposes, assesses that porker in the bosom of the church. Then he strikes the paper trail extending out through secular spaces into an editorial office, and, having assessed the grunter where it is, he again assesses it where it was last, and again where it was the time before, and so on through the whole series, until that not very valuable flitch of bacon, which has 'dragged at each remove a lengthening chain' of 'solvent credits,' has been the innocent cause of six payments into the State treasury. Beyond Mr. Young the assessor does not trouble himself to go, for on the ranch of a granger who is so intelligent as to exchange pigs for his papers the pachyderm's trail consists of tracks in the mud, and these the new Constitution neglected to declare to be property."

Money Property.—But, after all, says some objector, "notwithstanding your many and plausible arguments—your statement that all the world except the United States have done away with the old, atomic, inquisitorial system of taxation—I do not like your proposed reforms, and for the reason mainly that they exempt 'money property!'" It is most important, therefore, to inquire what is "money property," and also its relations to local taxation.

All capital or property is accumulated labor, labor being the source of all property. Hence any attempt to excite prejudice against capital or property, or to attack either, is an attack upon labor itself.

"Moneyed property" is generally understood to mean *evidences of debt*, which are not in a strict sense property; but *rights to property, or assignments of property*, according to the amount of interest of the creditor.

WHAT IS A MORTGAGE?—A mortgage may be defined to be a species of conveyance of property—mainly real estate—for the species of conveyance of property—generally real estate—for the security of a debt, generally created by a loan of money, and can not be regarded as a *complete*, but rather a *conditional* or *quasi-title* of the property covered by the conveyance. It is not so much property as a deed; and neither is property except to the extent of the value of the paper and the labor of writing or printing it, and still both are very valuable as conveying rights to property. The property is the real estate conveyed or mortgaged, and a tax on the land and another tax on the deed, or a tax on the land and another tax on the mortgage which covers the land, will in effect be a double tax on the land. This tax may be made a quadruple tax: first on the land, then on the deed of the land, then on the mortgage which is on the land, and then on the lease which the landlord may grant to the tenant.

The following curious instance of hardship in taxing mortgages actually occurred in one of the counties of central New York under the existing system: A worthy farmer and his wife, finding themselves becoming incapacitated through age from taking practical care of their little farm, sold it for five thousand dollars, and allowed the purchase money to remain in the form of a mortgage, with the expectation of living on the interest paid annually by the purchaser from the profits of the farm. The town being very small, the fact of the sale and the consideration paid became known to every one, and the assessors were compelled, in opposition to their usual practice, to tax the old man to the full amount of the mortgage, as personal property. But the year in which this was done happened to be a year in which the town, anxious to avoid a draft of men for the army, to which the old man was not liable, put up the rate of taxation to more than the legal rate of interest, in order to provide sufficient money to purchase recruits. The result was that the poor old man and his wife found that not only was all their income from the mortgage swept away by the tax collector, but they were even obliged to go out for days' work, in order to pay a balance of taxation and provide means of support; and this, too, while the identical farm for which the mortgage was given was taxed at one fifth its true value, and other investments of other citizens of an invisible and intangible character undoubtedly escaped taxation altogether. And this we call equality in taxation.

TO TAX INDEBTEDNESS IS TO TAX THE BORROWER.—If any one doubts that a tax on indebtedness is a tax upon the borrower, or the property which the indebtedness covers, that question can be easily solved by an *honest*, *uniform* tax on all State, county, town, and city

bonds hereafter issued, by making them all subject to an annual tax of one, two, or more per cent, and by providing that the tax shall be deducted at the time of the payment of the interest. Is there any one who believes that these bonds will sell in the market at the same high rate that they would command if by law they were free from taxation?

We can also test the effect of an honest, uniform tax upon mortgages by providing that mortgages hereafter made shall operate to reduce for assessment the valuation of the land mortgaged to the amount of the mortgage, and that the mortgagor shall pay the tax on the mortgage, and deduct the tax from the principal or interest, when paid to the mortgagee. But who believes, under such a law, that any money would be loaned at the legal rate of interest?

A somewhat curious piece of practical evidence, in support of the truth of the above position, in respect to the taxation of mortgages, has been afforded by an experience of New Jersey. This State exempted, in 1869, all mortgages from taxation in certain of her counties and cities which lie contiguous to New York city; but this legislation, although operating to draw capital away from New York and into New Jersey, was not primarily effected for any such reason, but was brought about in this wise: New Jersey, in the first instance, enacted an honest, uniform law of taxing mortgages, and one, moreover, which could with the utmost certainty be executed, and similar in principle to that above suggested; namely, that the person giving the mortgage should pay the tax on it, and deduct the tax from the principal or interest in settling with the creditor. The result was that all mortgages falling due were immediately foreclosed, and as no new loans, moreover, could be made, the inhabitants of the growing counties near the city of New York, wishing to borrow money on land, or to sell land, found themselves in an uncomfortable position; so much so, that if the law taxing mortgages in this section of New Jersey had not been promptly repealed by the Legislature, the issue would soon have become a predominant one in the State elections; and hence the explanation of one of the most curious statutes in the history of American legislation which made one tax law for one part of the State and another and a different one for the remainder.* But the point of chief interest in respect to this whole tax experience to which attention should be especially direct-

* "And all mortgages upon estates, chattels, or personal property, taxable by law within said counties of Hudson, Union, Essex, and the city of Brunswick, Middlesex County, and the county of Passaic, except the townships of West Milford, Pompton, and Wayne, for State, county, township, and city purposes, shall be exempt from taxation when in the hands of any inhabitant, corporation, or association residing or located in said counties or cities." (Approved April 2, 1869.)—*Laws of New Jersey, 1869, p. 1225.*

ed, is, that it did not take the citizens of New Jersey a great length of time to find out that a borrower of money on a mortgage paid the tax, and that the lender was the tax collector, and only paid his part of a diffused tax, as all other persons living, consuming, buying, or selling in the State must pay; and that if the borrower could not legally pay the lender a rate equal to other net profits of investments, he could not borrow. A little experimental legislation in other States will, therefore, effectually explode the vague theory that taxes *uniformly* levied do not diffuse themselves; and although it is true that the persons or property primarily taxed do not charge the entire tax over to others, this very fact nevertheless shows that the tax is diffused with *absolute equality* upon the persons who originally may pay the tax, and upon those who finally bear their portion of it.

Loans on Mortgages prohibited in Rome.—Mommsen, in his History of Rome, states that at one period the lending of money in that country on mortgages was prohibited, and it is apparent that a uniform taxation of mortgages would amount to a prohibition as effectual as the prohibition which existed under the Roman law. The Roman patricians, in their legislation, wished to prevent the common people from becoming an independent yeomanry, and owning and acquiring real estate through the facilities of borrowing upon mortgages. No chimerical attempt had then ever been made to tax money at interest, and this purpose of having the soil cultivated on shares or by dependent tenants could best be obtained by a prohibition of all mortgages.

Now, it needs no argument to show that a system of onerous taxation of mortgages must have a tendency to re-enact the Roman policy, and that it is undoubtedly the true interest of the state, on both political and economical grounds, to encourage occupiers to become owners, who always give better attention and protection to their own property than to the property of landlords.

Purchasers of Government Bonds not Practically Exempt from Taxation.—The purchasers of United States, State, and municipal bonds or securities, which are nominally exempt from taxation, are in effect taxed, and uniformly taxed in the high price which they are obliged to pay for these securities by reason of their exemption from taxation. It is not only a sound principle of political economy that a tax upon money at interest is simply a tax upon the borrowing price of the borrower, causing an increased rate of interest, or a reduced price to be obtained for the obligation given; but this principle has been adjudicated by the highest court of the country, so far as a court of last resort can adjudicate a great principle in economic science. Thus, in the case of Weston *vs.* The City of Charleston (2 Peters, 449), the Supreme Court of the United States, through

Chief-Justice Marshall, held that "*a tax on Government stock is a tax on the power to borrow money on the credit of the United States.*" If, therefore, we except the borrower from taxation in the form of a decreased rate of interest, we grant him no special exemption or advantage, for his property, which is covered by the debt, has already in other forms been taxed, and the exemption will diffuse itself in the form of lower rate of interest, which will be the means of producing a higher price of labor, land, and personal property, until the exemption is completely diffused. Who will then be injured by taking the tax from money at interest? It is probable that he who now adds the tax to the rate of interest, and charges the borrower, and does not pay it to the State, may lose by the change. He will be obliged to enter the open money market and pay the market rate, as the purchasers of Government bonds now do, for evidences of debt that will be free from taxation in the hands of all persons; and the laws of trade will regulate his investment as they daily regulate the price of Government bonds, and will bring down his securities to a rate of interest not much above the rate paid by the national Government. The exemption applied to United States bonds, which is of no practical benefit to the present purchasers, in consequence of the increased price of the bonds, would be of no benefit if applied to the holder of other securities in an established and permanent system, except in freedom from the uncertainties and irregularities attending the exercise of arbitrary and irregular power. If the exemption is an exemption of everything of the same class, it is perfectly equal and fair, and its effect is diffused and equated; and the tax on another article, taxed in lieu of the exempted class of articles, is likewise equated and diffused, and if invisible and imponderable evidences of debt can not be taxed equally no injustice will arise if they are all free from primary taxation, and if the taxes of a permanent system are imposed on other things subject to positive and fixed rules of assessment. The daily price of United States bonds, therefore, is a constant lesson that an exemption of a security from taxation is an exemption of the borrower, and the same law of political economy will rule in respect to both private and public debts. Each State has, therefore, the power to put its borrowers on an equal footing with the General Government, and without injustice or inequality toward the borrower or the lender.

THE OLD AND NEW IDEAS IN TAXATION.—The first attempt made to tax money at interest was instigated against money lenders because they were Jews; but the Jew was sufficiently shrewd to charge the full tax over to the Christian borrower, including a percentage for annoyance and risk; and now most Christian countries, as the result of

early experience, compel or permit the Jew to enter the money market, and submit, without let or hindrance, his transactions to the "higher law" of trade and political economy. But a class yet exist who would persecute a Jew if he is a money lender, and they regret that the good old times of roasting him have passed away. They take delight in applying against him, in taxation, rules of evidence admissible in no court since witches have ceased to be tried and condemned. They sigh at the suggestion that all inquisitions shall be abolished; they consider oaths, the rack, the iron boot, and the thumbscrew as the visible manifestations of equality. They would tax primarily everything to the lowest atom; first for national purposes, and then for State and local purposes, through separate boards of assessors. They would require every other man to be an assessor or collector, and it is not probable that the work could then be accomplished with accuracy. The average consumption of every adult inhabitant of the United States is at least two hundred dollars annually, or in the aggregate $1,500,000,000; and this immense amount would fail to be taxed if the assessment was made at the end of the year, and not daily, as fast as consumption followed production. All this complicated machinery of infinitesimal taxation and mediæval inquisition is to be brought into requisition for the purpose of taxing "money property," which is nothing but a myth. The money lender parts with his property to the borrower, who puts it in the form of new buildings, or other improvements, upon which he pays a tax. Is not one assessment on the same property sufficient? But if you insist upon another assessment on the money lender, it requires no prophetic power to predict that he will add the tax in his transactions with the borrower. If a tax of ten per cent was levied and enforced on every bill of goods, or note given for goods, the tax would be added to the price of goods, and how would this form of tax be different from the tax on the goods?

"Money property," except in coin, is imaginary, and can not exist. There are rights to property of great value. The right to inherit property is valuable; and a mortgage on land is a certificate of right or interest in the property, but it is not the property. Land under lease is as much "money property" as a mortgage on the same land; both will yield an income of money. Labor will command money, and is a valuable power to acquire property, but is not property. If we could make property by making debts, it can not be doubted that a national debt would be a national blessing. Attacking the bugbear of "money property" is an assault on all property; for "money property" is the mere representative of property. If we tax the representative, the tax must fall upon the thing represented.

FEET AND HANDS.

By M. BERNARD (Mrs. HENRY BERNARD).

II.

IN our last paper we described the feet of some of the chief groups of four-footed animals. We saw that in most of these animals the four feet are very much alike, because they all have the same kind of work to do—that is, walking or running. But when, in consequence of its manner of life, an animal comes to use its fore feet differently from its hind feet, as the kangaroo does, we find that a difference arises in the structure of the two. We now have to trace some of the more marked changes of this kind.

So far, all the animals we have mentioned have been land animals, all needing their feet for moving in one way or another on the ground. But, ages ago, some land animals changed their manner of life and took to living chiefly in the water, only occasionally coming on to the land, or even merely coming to the surface of the water when they were obliged to breathe, for they still had lungs, which needed to breathe air. To such animals (for example, seals and whales) ordinary feet were partially or altogether useless; they had chiefly to paddle or swim, seldom or never to walk, and, to enable them to hold their own against their water enemies, their limbs gradually became very much changed.

Taking first the seal, which even now climbs on to the land, we see all the four feet changed into paddles, but these paddles, being still occasionally needed for use on land, are not very unlike the feet of an ordinary land animal. In Fig. 1 we see that the fore foot of the seal (A) bears a considerable resemblance to his hind foot (B); there is some difference in length and in the posi-

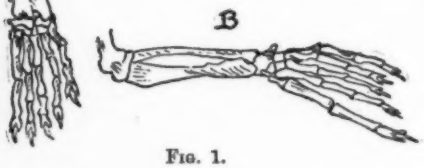

Fig. 1.

Fig. 2.

tion on the body, for the hind limbs face each other at the back of the body, but all four are paddles.

Taking next the whale, which has entirely given up coming on to the land, we find only one pair of paddles or changed feet. When the land ancestors of the whale took to living in the water, they probably had tails, which, by whipping the water, helped them to swim, and they evidently learned to wave the hinder part of the body

in the water as a fish does to help to push him along. They did not use their hind limbs at all for this purpose, and these, like all unused parts of the body, diminished in size and strength. In the whales now existing no hind limbs are to be seen, but traces of the skeleton of the hind limbs are still found imbedded in the sides of the fishlike body. How small these remains of the former leg are in comparison with the constantly used front foot, now a paddle, may be seen from Fig. 2 A and B.

Again, ages ago, other land animals managed to raise themselves from the ground into the air, the better, no doubt, on the one hand, to escape from pursuing enemies, and, on the other, to catch flying insects. For supporting themselves in the air, wings of some sort were necessary, and so the front legs in such animals gradually altered.

Although none of these first flying animals are now in existence, we know pretty well what they were like, as impressions of their bodies have been left upon slatelike rocks. They were animals in many ways like reptiles—i. e., belonging to the same group as the crocodile, whose five-toed fore foot was illustrated in our first paper.

In some of these first fliers all the five toes were retained; four were of ordinary length, but the fifth was immensely long—longer, in fact, than the whole body of the animal—and between it and the body a skin was stretched, making a wing.

Here we have somewhat the same method of flying as we now find in the bat. In a bat's outspread wing (Fig. 3 A) the five rays of the fore foot are quite clear. Four of them are joined together by thin skin which stretches back to the leg and the tail. The lower part of the arm and three of the rays which carry the flying skin are greatly lengthened, and so a very large wing is obtained. The first ray, which we might call the thumb, remains short and ends in a strong claw that is of use in climbing.

We thus, in the bat, have an animal with the fore foot extraordinarily changed to suit it for a special manner of life—i. e., for flying. The hind foot (Fig. 3 B), not having any new kind of work to do, is much less changed. It has five ordinary toes ending in claws, with which the bat climbs or hangs on to trees. So well fitted are the hind feet for this kind of work that many bats always sleep wrapped up in their wings as in a mantle, hanging on to the branch of a tree, head downward.

But not all of the first flying reptiles developed wings of stretched skin. Some came to fly by means of feathered wings not unlike those of birds. Fig. 4 shows the bones of the fore foot or wing of a small creature called the *Archæopteryx*, or first feathered flier. This animal had three distinct toes, each ending in a claw. Two toes had thus already been lost, the fourth and fifth, which also are

never found in any bird. The feathers of this creature grew out of the skin of the arm and of the third finger.

In the fowl (Fig. 5) and all other birds the wing is, as in the *Archæopteryx*, a feathered fore leg and foot. A, B, C, in Fig. 5, are the leg bones, and the rest represents the foot, which retains in part the three rays seen in the *Archæopteryx*. Two of these rays, however (1 and 3), instead of having several joints, are nothing more than short, pointed bones. U C and R C are the only bones of the "wrist" left, and MC II and MC III show all that remains of the bones

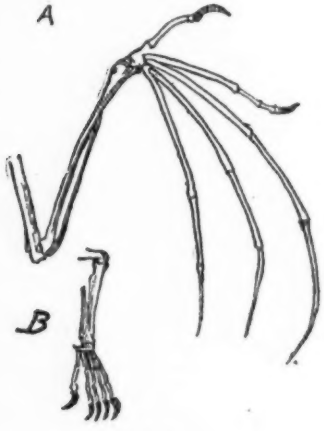

FIG. 3.

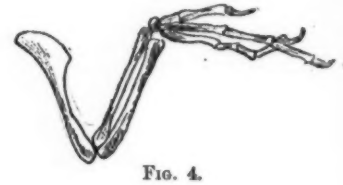

FIG. 4.

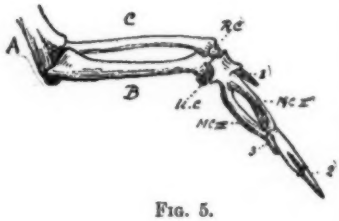

FIG. 5.

which in a four-footed sole-walker form the flat of the foot. 1 is the remains of the first toe or digit, 2 is the long second digit, which still has three joints, and 3 is the one remaining joint of the third digit, which is not distinctly separated from the second. All the other parts of the lizardlike fore foot have disappeared, because this was quite enough to serve as a rigid support for the skin which carries the feathers.

The domestic fowl, of course, uses its wings very little; it walks more than it flies. Most birds use their wings much more, and some of these have more of the bones of the original foot left. Other birds fly still less than the fowl. The penguin, for example, uses its wings not for flying but for swimming, and the bones have become much flatter and broader than those of ordinary birds. The feathers that cover them are exceedingly small, almost more like scales than feathers, so that the whole wing is flat and paddlelike, and is very suitable for acting as an oar in the water.

In some of the ostriches, which also never fly, the bones which support the wing are reduced to mere stumps, even the second digit having only one joint.

The hind feet of birds are less changed than the fore feet, but still differ from the lizardlike foot in the number and character of their toes. Some birds have four toes, others only three, and these toes are usually able to curve so as to grasp the branches of trees, and are armed with claws which help in climbing. In the birds which run along the ground instead of flying, like the ostrich, there are usually only two toes, which become very much thickened. Here, as in the horse, we find increased speed in running obtained by reduction of the number of toes. The horse, as we saw, actually has only one toe, and in some ostriches the second toe is so reduced that they practically have only one also.

Great as is the difference between the fore and hind limbs of the bird, that between our own hands and feet is quite as important. The fore feet of all animals have sometimes been called "hands," to mark the fact that they correspond with what in a human being is the hand, but in the animals we have considered we have had nothing like a hand in the true sense of the word. In a true hand, the inner finger is able to move in such a way as to face the other fingers, and the hand is thus able to grasp any object far more firmly than if the movement of all the fingers was similar, as it is in the foot. Such an inner finger is called an opposable thumb, and its presence is absolutely necessary to a real hand.

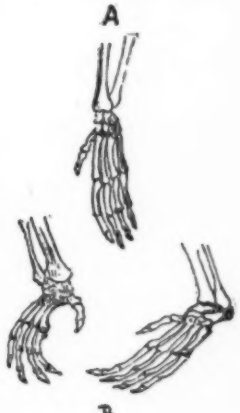

FIG. 6.

Let us see if we can understand how such true hands arose. Besides the animals which run about in various ways on the ground, those that have taken to living in water and those that have learned to fly in the air, there are others that live almost entirely in trees, climbing or springing from branch to branch, and only occasionally walking on the ground. These animals, the monkeys, which feed principally on the fruits that grow on the trees they inhabit, need agility in climbing rather than swiftness in running, both for obtaining their food and for escaping from their enemies, and so all their feet have become specially adapted for firmly grasping the branches of trees—i. e., they developed thumbs on all their feet; for this reason they have been called the *Quadrumana*, or four-handed animals.

If we examine the hand and foot of a gorilla, given in Fig. 6 A and B, we shall notice that the hand (A) differs very little from the hand of man, given in Fig. 7 A. The feet of the ape, however, differ considerably from those of man (*cf.* Fig. 6 B with Fig. 7 B).

There is no doubt that the very earliest men spent their lives much as monkeys now do. They probably lived partly in trees before they learned how to build houses in which they could take shelter from bad weather and when threatened by animals that were much stronger and could run far more swiftly than they. Thus our hands were once developed for climbing about trees, and since that time have changed very litle in shape. As man became civilized, his hands were put to nobler uses; they were his best instruments for accomplishing all he achieved. Our hands are thus much more flexible and capable of a far greater variety of movements than the hands of the less civilized monkey.

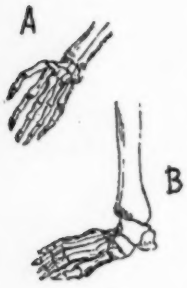

FIG. 7.

The hind foot of the monkey was not well suited for man's way of life. One great difference between man and the monkeys is that man walks and runs in an upright position on his hind feet alone, while even the most manlike of the apes walk only partly upright, not supported entirely by their feet but helped along by their hands, which, on account of the great length of the arms, can easily reach the ground. In a man, walking upright, the weight of the body is thrown entirely on the hind limbs, which in him become the lower limbs, and the feet are needed to form a firm pedestal for the whole upright body. Thus in man, the once climbing feet having given up climbing, the useless thumb gradually changed back again into a simple great toe, and the first joints of the rays lengthened out to form a firm flat sole. We can still see some signs of the former thumblike condition of the great toe in little children and in some foreign races. In babies, the great toe is often more or less opposable to the others, and among the Japanese it is still so much so that a Japanese workwoman often holds the work she wants to stretch between her toes, which are able to grasp it firmly.

Men and women have, as a rule, five toes and five fingers, the largest number found in animals; but it is by no means certain that this number will always be retained. The foot of a civilized man is always covered by stockings and shoes, and the toes are hardly used at all, and, like the toes not used in the feet of animals, appear to be diminishing in size. The little toe in a comparatively large number of human beings already has only two joints, and some of the other toes also seem to be becoming shorter. It is thus quite possible that at some future time the human little toe will altogether disappear, and that man may have only four toes, or even, in course of time, fewer than four.

[*Concluded.*]

EDUCATION IN THE ANIMAL KINGDOM.

By M. CHARLES LETOURNEAU.

LIKE man, animals, especially those of the higher orders, are born with a latent, inherited education, the effects of which are manifested in the course of individual development. Our organs, for instance, which have been slowly built up during the evolution of the various specific types, act of themselves, each in its own way. They have their own memory. The digestive, circulatory, and respiratory organs, the senses, etc., discharge their functions spontaneously and without waiting for lessons from any master. The young animal left to its own impulses usually comes very soon to take care of itself in the great world, to avoid its enemies, and find food and a comfortable bed. Except in species that live in larger or smaller societies, parents drive away their young as soon as they have arrived at a stage in which they can take care of themselves. This fact is easily observable in birds, even when they are domesticated. The solicitous care of turtledoves for their young gives way to pecking and wing striking as soon as the latter are developed. Eagles drive their grown-up young from the nest, and even from the neighborhood. Some other species take care for the future of their offspring, and before sending them away teach them to fly, or swim, or hunt, or fish. Dureau de la Malle saw falcons, high up in the air, drop dead mice and swallows in order to teach their young to spring upon their prey when in rapid flight, and to estimate distances; and when the little hawklets were somewhat larger, they dropped living birds instead of dead game. American crested ducks teach their young to find seeds and to snap at flies and aquatic insects.

It is generally the female that exercises this care for her offspring, while the male concerns himself little about the matter. The female wild duck leads her brood to the water, and takes care to choose places of no very great depth for this first lesson, and trains the little ones to hunt flies, mosquitoes, and beetles. The female of the eider duck gently carries her ducklings one by one in her beak, escorts them to the deep water, and teaches them to dive for fish. When they are tired she glides under them, takes them on her back, and carefully carries them to the shore. It is undoubtedly very largely by virtue of instinct and ancestral education that birds swim or fly, and the mother has only to invite them to the act by her example; but, for a more complete training, the lessons are very useful, if not necessary. These lessons given by the parent birds to their young are the more impressive because birds have a vocal language, developed to a certain extent, and the example is enforced by admonitions,

encouragements, reproaches, and appeals, calculated to stimulate the natural tendency to imitation. With some species of birds this language too is taught; the individuals collect every morning and evening in chattering groups, and the young, enjoying the benefit of a social conversation, easily learn to sing and chatter. Singing birds sometimes, too, give one another lessons without thinking of it. Some birds sing badly when they have grown up alone, without the fellowship of companions of their species; others readily learn the songs of strange species, and even of man. Dureau de la Malle taught a starling to whistle the Marseillaise, and the bird in turn taught its fellow starlings of the neighborhood. These abnormal acquisitions, however, have not the fixity of hereditary instincts, and are easily forgotten unless constant care is exercised to preserve them —being, in this respect, very much like what is learned in the schools for the examinations.

Numerous facts similar to those we have cited have been collected by naturalists, travelers, and observers concerning education among mammals. The mother bear, for example, takes great pains in the training of her cubs; she teaches them to walk, climb, and eat, and inflicts punishments in the shape of cuffs and bites to insure success; and the cubs never resist, even if they are larger and stronger than their mother. A female elephant has been seen giving swimming lessons to her calf, and correcting it when it blundered. Working animals instruct their young by associating them in their labors. A female beaver has been observed to cut down a willow, gnaw the bark, and trim off the branches, while her young imitated her, and finally helped her carry a limb to the water.

When lions were still numerous and easily observed in southern Africa, they were sometimes seen instructing one another in voluntary gymnastics, and practicing their leaps, making a bush play the part of the absent game. Moffat tells the story of a lion, which had missed a zebra by miscalculating the distance, repeating the jump several times for his own instruction; two of his comrades coming upon him while he was engaged in the exercise, he led them around the rock to show them how matters stood, and then, returning to the starting point, completed the lesson by making a final leap. The animals kept roaring during the whole of the curious scene, "talking together," as the native who watched them said. By the aid of individual training of this kind, industrial animals become apter as they grow older; old birds, for instance, constructing more artistic nests than young ones, and little mammals like mice becoming more adroit with age. Yet, however ancient in the life of the species these acquisitions may be, they have not the solidity of primordial instincts, and are lost rapidly if not used.

While among the mammals this business of training is usually intentional and a family matter, attended to by the mother, with such invertebrates as bees and ants, in which the females are simply egg-laying machines, the mother's educational function is null, and the care of the young rests with the sterile workers. Yet the mental side of the maternal function subsists in mother ants in a latent state, and virgin females have been seen, according to Huber, busying themselves with the eggs and the larvæ. But as a rule the training in the nest is a grand social affair, committed to the female workers, who devote themselves with complete abnegation to their task, and seem to enjoy themselves in performing it. When the young have gone through their metamorphoses, their nurses, now become instructors, keep with them, guiding them through the labyrinth of the city in all its windings; and this education is probably carried much further than observers are able to follow it, for the working ants must be trained for their duties. Their industry is too complicated to be purely mechanical and blindly instinctive as is often supposed. But the observation of this training requires distinctions between individual ants which the human eye is hardly competent to make. Among the slaveholding ants the education consists largely in transforming certain inveterate tendencies. They make war upon another species, the brown ants, capture their young, and bring them up to be their own slaves, in ignorance of the species to which they belong, and of its traits. An equivalent to this transforming tendency of education may be found among the vertebrates, where, if we take the young early enough, we can disturb their hereditary functional manifestations to a considerable extent. Young chickens, raised apart, do not learn to drink by filling their beak and raising their head, but plunge their bill into the full vessel. Newborn babes soon lose the faculty of sucking if they are fed with the spoon.

All this is because, notwithstanding morphological differences, all living beings have something in common at the bottom; so that the physiological psychology of one species may illustrate that of others, and even of man. In short, we have good grounds for saying that all animals, whether vertebrates or not, but possessing nervous centers, however little developed, are susceptible of education; with all a suitable training long enough continued can to a certain extent derange the hereditary tendencies which we call instinctive, and even create new ones. These perturbations, these metamorphoses of native tendencies, are observable with special ease in domestic animals. We have a right to be surprised that, after having so successfully adapted the few animals with which we are acquainted to his service and use, man has not tamed many others. We may suppose

theoretically, and it is made probable by numerous experiments, that there are few among the superior species that would resist a methodical and persistent training. It should be remarked that except the cat, which is largely indocile, most of our really domestic animals belong to social species which in the natural state lived in larger or smaller hordes or companies, and whose communal life had taught them to submit to the more or less despotic will of their stronger companions. But there are social species which man has not domesticated, and there are other species which only require a longer education. In fact, various solitary and ferocious animals, as the wolf, bear, lion, panther, etc., have more than once been tamed or broken in by special education; and during the prevalence of the amorous passion the females of the wildest animals permit themselves to be approached by man, and even ask to be caressed. Experience has shown that all training is relatively easy when addressed to the young. By judicious application to the business, by being severe or kind upon occasion, animals of the most ferocious species have been tamed. A panther has been taught to use its paws gently as a cat, simply by rewarding it with a little lavender water, the odor of which is delicious to it. But it should be said by way of caution that with animals as well as with man, a too brutal education destroys the character by developing a malicious cunning, only partly dissimulated by an apparent submission.

Vicious horses are generally the result of a violent, barbarous training, and when the greater number of the horses in any country are tricky and hard to manage, it means that they belong to a brutal population. From time immemorial the contrary has been the case among the Arabs, where colts are brought up and exercised with almost maternal solicitude. The child amuses itself by petting and playing with the colt of which he is some day to be the rider, and the horse and his cavalier grow up together. The earliest education of the young animal begins in the family, in the same tent. The colt is constantly looked after and caressed, and is never chastised except for acts of malice or disobedience. He is given the choicest dainties of food, and is gradually accustomed to make himself useful. When the bit is put in his mouth the iron is covered with wool, so that it shall not bruise his lips, the wool having been dipped in salt water to give it a pleasant flavor and make him like it. The animal's education is thus always carried on with constant discretion, and even after it is completed the trainers never indulge in blows or hard words. By such association a real bond of friendship is formed between the beast and his rider.

The art of falconry alone is enough to prove that it is possible by a proper mixture of severity and kindness to tame to a certain extent,

if not to render amiable, fierce animals of moderate intelligence; and the argument is of more force because the training in falconry was given to adult birds. Very little was done with birds taken from the nest. They were doubtless more readily taught, but became only indifferent hunters. The old books on falconry explain in great detail the methods of proceeding in training adult falcons or haggards; and some tell how one should keep them company and make friends with them.

When it comes to more intelligent animals, like the elephant and the dog, the process of education is much less awkward, but its nature is at bottom the same. Our dog has so long been the associate of man that we may truly say it is born domesticated, and nothing is left to be done but to train it for various useful purposes. But it is different with the elephant, which is captured wild and adult; and the processes to which recourse is had in training it are, therefore, of particular interest to us. If the education of the adult elephant can be effected without very great trouble and in a fairly short time, it is because we have to do with an intelligent and even reflecting animal, which holds an accurate recollection of events, and is capable of reasoning about them—which, in short, acts almost as a man would do.

As much might be said of some of the monkeys—of that chimpanzee, for example, which the French naval officer Grandpré saw on a ship working at the capstan, assisting in the management, stoking the furnace, etc.; or of those primates which are utilized at Sierra Leone for the performance of many labors of man. If the larger monkeys had been domesticated by man, and associated with him for thousands of years as the dog has been, it would not be unreasonable to suppose that they would have been still more modified, morally and physically, than that animal. They would probably have made a closer approach to the inferior human races; for the dog, different as he is from man, has been remarkably humanized by his contact. This mental humanization of the dog is an extremely important fact, as showing how powerful education may be; how, if time enough is taken, it may modify the organization. The domestic dog is evidently descended from one or several canidian ancestors similar to the wolf, very wild and not very intelligent, but endowed with a social instinct. Many centuries have been required to change it into the devoted companion and worshiper of man that it is, to acquire its expressive bark instead of the wolf's howling, and to assimilate the many qualities and capacities it exhibits so foreign to its nature. Its civilization has not taken place all at once. We still find half-wild dogs among the Australian hordes and other lower races, that do not know how to bark, that have no affectionate rela-

tions with their masters, and are nothing more than selfish auxiliaries in hunting or fierce sentries of the camp or village.

The qualities we prize in our domestic dog are those traits it has acquired by education, and correspond to artificial cerebral impressions not yet made fully permanent; for they are easily effaced when the animal, deprived of human society, relapses into savagery. This development of the dog in so remarkable a manner is the result of his having been the first mammal domesticated; hence man has been more occupied with him, has demanded a greater variety of services from him, and has taken more lively care of his moral and mental education. Other animals, on the other hand, domesticated simply for the butcher's handling, like the ox, the sheep, and the pig, have degenerated rather than gained by the association with man. They have lost the qualities they acquired during their ages of liberty without replacing them by others, and have fallen back toward the vegetative life.

Domestic animals sometimes acquire special educations of themselves, by the mere force of spontaneous imitation. Such are the dogs which, raised by cats, have learned to lick their paws and wash their face and ears, like their nurses. So several birds in a cage will imitate one another's cries, and even those of mammals; and parrots, as we all know, imitate the human voice. The brighter birds even do this spontaneously, without special training. This fact leads us to consider the faculty of language in animals, and the degree of development that may be given it by education.

It can hardly be pretended at this period that spoken language forms an impassable barrier between man and animals. There are many kinds of languages, and human speech does not differ essentially from the tactile and antennal language of ants. The mode of communication, indeed, varies according to the organization of the animal species; but it may always be found to originate in reflex actions, determined by a need, a desire, a feeling, an emotion, or an idea. Spoken language, which has, scientifically, been associated with the cry, the interjection, or the imitative onomatopœia, is at bottom nothing but a reflex action, a laryngeal gesture. A comparison of human and animal language is therefore legitimate, and is of interest in that it shows how the latter can be perfected by exercise and education.

It is evident that the particular form of language will be imposed by the organization of a species. Thus ants, organically aphonal, have devised for communication among themselves the antennal language, which places all the members of their city or nest in intimate communication. With birds, mammals, and men it has been more convenient to acquire a vocal language; but on occasion

men, too, have recourse to the tactile language. I once knew an elderly woman, deaf and blind, who could be conversed with in silence by touching one finger or the other, or this or that joint, to designate the different letters of the alphabet and even certain words and punctuation points. Travelers in the Orient, especially Chardin, have described a similar language as used by Persians and Arabs in making their bargains, so as to evade the impertinent curiosity of the crowd.

Singing birds have the advantage in language over all other animals except man. Among them, Syme has distinguished six classes of expressions: the call of the male in spring, the noisy sounds of mistrust, the warning uttered when a bird of prey is seen, the call of parents and the response of the young, the warbling or cooing of love, and cries of fear or of alarm for the nest. It is not necessary to suppose that this language of birds is inborn. It results, on the other hand, from acquisitions made during the life of the species which are not completely transmitted by heredity. Young birds have to go through a process of teaching to sing well. Their first efforts may be compared with the prattle of children. Singing language is the property only of particular species of birds. The crow does not sing like the nightingale, although it has a similar larynx. Young birds learn to sing by spontaneous imitation and practice, and of course take the song of their parents; but in aviaries they often copy the songs of other species, just as our children learn foreign languages by hearing them spoken. It therefore seems clear that the artistic talent of singing birds has been slowly acquired. The dog did not learn to bark till he fell into the society of man. He does not, indeed, imitate human language; but, desiring to express novel feelings, he has created a language of his own in order to communicate with his master: barking, four or five tones rich. The domestication of the dog is further so ancient a thing that it is pertinent to ask whether man himself had at that time any other language at his disposal than modulated cries. But although they do not speak as we do, dogs very well understand some words and phrases, and by training this intelligent comprehension of language can be greatly enriched. Their mental condition may be compared in this respect to that of our children between the ages of ten and twelve months, who understand a considerable number of words, but are not yet able to articulate them. So, likewise, an adult man going into a foreign country learns to understand the words of the new language before he begins to speak them.

Our dogs understand, too, the languages of animals of different species with which they are associated. The dogs Houzeau kept in Texas to guard his poultry yards responded to the cries of the fowl

indicating that they were in danger, but not to the others. So wild dogs and howling dogs learn to bark after they become accustomed to hear their tamed companions bark. In view of the facility with which parrots learn to articulate words, it may be assuming too much to say, dogmatically, that animals can not be taught to speak. Instances are not wanting in which parrots have seemed able to speak intelligently. A very striking case of the kind is that of the parrot and the Duke of Nassau, cited by Locke in his Essay on the Human Understanding. Darwin mentioned a parrot that always said "Good morning" and "Good evening" correctly.

All these facts I have mentioned seem to me to demonstrate that the education of animals rests on the same basis as that of man; that in numerous species parents give their young a practical education, but of short duration; that an artificial education imposed by man is competent to divert and even metamorphose what are called the instinctive tendencies of animals, and give them new ones; and that repeated drilling of young animals, assisted on occasion by chastisement and recompense, is usually sufficient to obtain this result. It would be easy to show that human education does not proceed very differently, and that among inferior races it does not diverge greatly from that which many animals give their young.—*Translated for the Popular Science Monthly from the Revue de l'École d'Anthropologie.*

THE PRIMARY SOCIAL SETTLEMENT.

By KATE KINGSLEY IDE.

WITH the close of this century the "woman question," as such, will have practically settled itself in the United States, to the immense relief of a great number of people. In its wake have followed "child study," of special interest to kindergartners and mothers' clubs; paidology, the new science of the child, claiming the attention of college men and demanding a college chair; and oikology, a new name for the science of housekeeping or household economics. Oikology, from its Greek derivation, includes also family life or homekeeping, which has but recently appeared on the horizon of science and literature as worthy of particular study. It will not be in dim perspective much longer. The question of the family, of transcendent importance, is sure to come nearer and nearer, to grow larger and larger, and to demand the attention not only of economists and sociologists but of thoughtful men and women everywhere. The national "Congress of Mothers" will soon

be superseded by that of fathers and mothers, and, finally, by that of the whole family. It is in the air that the family, the home end of the social problem—the primary social settlement, if you please—is to have a renaissance, a new birth. Twenty-five years ago Charles Dudley Warner feared that with the going out of the hearthstone and the hearth fire, with its big aromatic back log of hickory, the family would go. It has not gone, but it has suffered neglect and decay to the extent that, like a smoldering fire, it needs new fuel and a big bellows to blow the embers into healthy life and warmth, to create a family atmosphere and make it contagious.

Because the disintegration of the family is threatened, because its decline is asserted, because family life in America has become a target for some foreigners to shoot unpleasant remarks at, there is no reason to take a pessimistic view, but rather to believe that family extremes have met, that the family pendulum has swung either way as far as it can, and will, according to the law of rhythm and reason, swing back to middle ground, to reorganization, resetting, reintegration.

It is incongruous in a country widely reputed for its homes that the house should be better than its inmates, the container of more account than the thing contained. To this end public opinion, that mighty factor in all forces, including social, needs to be aroused. The general thinking and reading public is not yet awake to the family idea. I know of no practical and pertinent subject that there is such a dearth of literature on as on family life, of more importance in the history of nations and in the history of the world than any other one thing. I know of but one entire book * on the subject, and that was published ten years ago, and discusses the family historically more than ethically and sociologically. There are, however, chapters in several books that treat of the family in a scientific way. Our government, in the interest of science, sends out expeditionists to discover the north pole. For the sake of humanity as well as sociology, which "is nothing but systematic knowledge of human beings, who have always been commonplace and at the same time mysterious," it has become necessary for expert observers to discover or rediscover the family, and for the family to discover itself as microscopic society, and especially as the prototype of the nation. The old-time classification of social institutions into family, church, and state, with the family as the unit of society, and society the aggregation of families, has been somewhat changed. The individual is now the unit of society, and in some quarters of Germany and this country there is added a fourth

* The Family. By Dr. Thwing.

class, "civil society, thereby designating economic life." They have some difficulty in disposing of the family, but are inclined to set it aside as an institution by itself, closely related to all the others, calling it the "primary social form," in which the cell, the individual unit, is found. I think it is Dr. Mulford who says: "The family is the natural and the normal condition of human existence. It is not the unit of society that is the ultimate and integral element, but it is the unitary form of society." Yet, as the individual is rarely separate from and outside of some kind of a family, and as social life is more generally concentrated in the family than in any other institution, I can not see that it makes the family more or less primary—that is, *chief in importance*—either by calling it the social form of the unit of society, or the unit of society itself. The old system of classification will probably continue to be used in philosophical if not scientific discussion of social institutions.

Conditions past as well as present must be understood before one would dare prescribe remedies for the present threatened disintegration of the family. A surgeon, before attempting a certain operation, has his assistant spend hours with the patient, writing up the history of the case, as to heredity, environment, causes and effects, not only for his own benefit and the patient's benefit, but for the benefit of surgery in general. A history or prehistory of the family case is altogether too long for a magazine article, but we may get kaleidoscopic if unsatisfactory views of the family in its evolution by means of such authorities as Moses, Homer, Christ, Paul, Plutarch, Dr. Hearn, Sir Henry Maine, Letourneau, Starcke, Professors Maurice, Drummond, and Small.

One should never judge of the ancient domestic institution by any modern standard, as is too commonly done. Neither is it well to use the modern name, family, but rather household, for the Semitic and Aryan domestic establishments, so extensive and complicated in their various ramifications, laws, and customs. From the Semitic (more properly Shemitic) household the modern family has evolved, although Herbert Spencer is at variance with the theory that the infancy of society is found in the patriarchal group. His evolution goes back to an aggregation of males and females without settled family arrangements. Be that as it may, it is a fact that all societies were originally organized on the "patriarchal theory," based on the scriptural history of the Hebrews. The Hebraic household was really a corporation. At the head of this corporation was the patriarchal father, with absolute power over wives, children, servants, household property, and in a representative way over the flocks and herds of his sons. Such households were those of Abraham, Jacob, and Laban.

Modern ideas of the family are based, of course, on monogamous marriages, which many people seem to think did not exist either in sentiment or reality until the Christian era. This is a big mistake. In the original divine ordinance of marriage, "And the Lord God said, It is not good that the man should be alone: I will make him an help meet for him" (Genesis, ii, 18), and "Therefore shall a man leave his father and his mother and shall cleave unto his wife; and they shall be one flesh" (Genesis, ii, 24), monogamy is implied, and also in what Christ said in Matthew, xix, 5, 6, and Mark, x, 7, 8. Monogamic, polygynous, polyandric have always been numerators over the common denominator, marriage, yet for reasons pertaining to personal comfort the monogamic family has been the commonest, and existed in higher nations long before the Christian era. But Christianity gave a new motive for its existence. It made the underlying spirit of family life more important than the laws and customs pertaining thereto.

Among the Semites, confusion, trouble, and hatred ever resulted from the practice of polygamy, which, though not prohibited by Moses, was restrained and discouraged. The first-born, whether of the beloved or hated wife, was to have his right, and citizenship was denied to eunuchs.

But even in the domestic darkness of polygynous households, parental love often shone like a bright light, though sometimes it was the light of favoritism. "And Isaac loved Esau." "Now Israel loved Joseph." Hagar, lifting up her voice and weeping over against the shrubbery where she had placed Ishmael, so that she could not see him die, is a most pathetic picture of a mother's love. The love of home, too, was strong even in the wandering days of the patriarchs, who delighted to obey the frequent command, "Return unto the land of thy fathers and to thy kindred." In other family affections these old Hebrews are still an example for us. Ruth's love for and companionship with her mother-in-law, Naomi, is a touching part of the beautiful biblical idyl. Old age was revered. The grandfather's blessing on the sons' sons was of greatest account. His words were desired and cherished. Even Rameses sought and obtained the blessing of the old man Jacob, who was given by the king not simply a living place in some corner of Egypt, but in "the best of the land." Brotherly love was often conspicuous in contrast to brotherly hate. Joseph, the ruler, in the second chariot of Egypt, not only looked after his father by express command of the king, but his brethren and all his father's household, "according to their little ones."

The influence of this primitive social institution, the ancient family or household, has been felt in law also. Maine says: "It is this patriarchal aggregate, the modern family thus cut down on one side

and extended on the other, which meets us on the threshold of primitive jurisprudence. Older probably than the state, the tribe, and the house, it left traces of itself on private law long after the house (another name for gens) and the tribe had been forgotten, and long after consanguinity had ceased to be associated with the composition of states." He also says: "It will be found to have stamped itself on all the great departments of jurisprudence, and may be detected as the true source of many of their most important and most durable characteristics." This is but another proof that the best things in law and love are always up to date.

Polyandric households prevailed to some extent where women were outnumbered by men, and polyandry is practiced now in some parts of Europe, India, and among certain tribes in the Pacific Islands and America. Among the usually polygynous Indian tribes, the Iroquois was a single monogamic exception.

Polygynists and polyandrists can never have known love in its quintessence. Love, unlike coffee, can not be diluted with safety for family use. Only the pure, strong extract is the basis of a true union between one man and one woman. And such a marriage is the only fit foundation for family life. True, there have been weddings—that is, ceremonies, festivities, and trousseaux—without love, but if the family had depended on the mere correlation of the sexes it would have died an early death as an institution. Professor Drummond explains how conjugal love came into existence in this way. Speaking of the loveless marriages of the early races and how love came, he says: "If neither the husband nor the wife bestowed this gift upon the world, who did? It was a little child. Till this appeared, man's affection was non-existent, woman's was frozen. But one day from its mother's very heart, from a shrine which her husband never visited nor knew was there, which she herself dared scarce acknowledge, a child drew forth the first fresh bud of love which was not passion, a love which was not selfish, a love which was an incense from its Maker, and whose fragrance from that hour went forth to sanctify the world."

However, it was never intended that parenthood should precede conjugal love, but rather that it should strengthen it. Mrs. Browning's interpretation of conjugal love in the first human family before the first baby came seems reasonable and right. In the Drama of Exile, Adam thanks God

> "That rather, thou hast cast me out with her
> Than left me lorn of her in paradise,
> With angel looks and angel songs around
> To show the absence of her eyes and voice,
> And make society full desertness."

And Eve responds:

> "I am renewed;
> My eyes grow with the light which is in thine;
> Because I comprehend
> This human love, I shall not be afraid
> Of any human death."

Monogamous love marriages have not only improved the family physically, psychically, and ethically, but society as well. The decline and fall of Rome can be traced to her corrupt domestic life. The moral progress of the nation ceased when sacred family life ceased. The names Pompey, Cæsar, Antony, Cicero, not only suggest intellect, power, splendor, conquest, and oratory, but divorced wives, paramours, unfathered and unmothered children, and marble palaces that hadn't the faintest semblance of homelikeness. The high civilization of Rome could not afford to throw off the family, which, then and now, either as a blessing or curse, is the primary social group from which evolves all society. The advancement of learning has never yet been sufficient gain for the loss of domestic morality. But even in the so-called morally pure Roman households, family right swallowed up individual right as a larger fish swallows the smaller. The *paterfamilias* was a tyrannical lord, who crushed any signs of asserted individualism. Pride of ancestry and patrimony surpassed natural affection. Occasionally there was a Catonic exception, who believed that a good husband was more praiseworthy than a great senator. We know that the elder Cato left urgent business to help wash and dress a newborn son, that he taught the growing boy to read, to use correct language, to box, to swim, to fight in armor, and to endure hardships. He even wrote historical books with his own hands and had them printed in big characters, that the boy at home might read of the brave deeds of his countrymen and thus unconsciously imbibe patriotism. It is significant that the dignified Roman Portia boasted not only of being the wife of Brutus, but a Cato's daughter.

Homer looked upon domestic relations, in some sense, as divine relations. Odysseus constantly had consideration for home and wife. The sanctity of the marriage vow is noticed particularly in the Iliad, a poem that does homage to hearth and home. And when conjugal and parental relations in classical Greece were outraged, she too, like Rome, felt the result in all her social fabric. At the time when her children were looked upon chiefly as additions to the state and army, we get a glimpse of a certain family relation not wholly unlike that of to-day. Themistocles, when his son was making demands on him by means of his mother, said: "O woman, the Athenians govern the Greeks, I govern the Athenians, but you govern me, and

your son governs you; so let him use his power sparingly, since, simple as he is, he can do more than all the Greeks together."

The ancient household in Hellas and Italy was held together by authority, obedience, and domestic worship. The hearth was the altar—the Vesta—with its holy fire. The Aryan house father never died, but lived on in his male successor and in the family hearth worship to his memory. The Lares and Penates devotion was a crude religion, but veritable. The hearth was the family center, the house spirits were the guardians of the hearth. Everywhere primitive religion seemed to be domestic. It is related that the Russian peasant, in changing his house, raked the fire from the old stove into a jar and carried it to his new home, where its arrival was greeted with the remarkable salutation, "Welcome, grandfather!" If the fire for any reason could not be taken, a fire shovel or poker was substituted. In the brownie, hobgoblin, and Robin Goodfellow of the British Isles it is easy to trace the belief in ancient house spirits. In the Orkney Islands, hardly more than a century ago, there was in every family a brownie who was so helpful in corn-thrashing and house-cleaning, and withal so fond of milk, that "when the people churned, they sprinkled a little of the churning in every corner of the house for Brownie." I suppose this appeasing perquisite for spirit drudgery was but a forerunner of the modern servant's "tip," an abbreviated form of "to insure promptness."

As we come to the Christian era, the old family idea begins to wane. Christ emphasized the family, but also the relative importance of the individual in the family, and the immense importance of little children and childlikeness. From the fact that the founder of Christianity was born and lived in a family, there arose a new conception of fatherhood and motherhood. From the fact that John the Baptist was the cousin of Christ, and James, the author, his brother or near relation, and the Bethany family his close friends, the bond of brotherhood, blood relationship, and friendship has increased significance. That the Christ had a long family pedigree with royal blood in it is of interest; but it is more interesting to know that the carpenter's son, in a poor family (immediate) with meager surroundings, became a great man followed by crowds of the common people, in spite of a prevailing unbelief in his Messiahship. It is of supreme account to any family that this Jewish boy, growing tall and learned and in favor with God, was not disagreeable to men and was subject to his parents in all matters, except in the sphere of conscience, where even parents may not enter unbidden.

It is doubtful if Paul had wife or children, yet he seemed to know a great deal about other people's children and family life, at such great centers as Ephesus and Corinth. His lengthy commandatory

advice in this direction, and his calling attention to the moral inheritance of the child in the case of Timothy, show that he considered the family the primary social settlement.

Feudalism was, perhaps, a means of developing individualism in the family. Dr. Thwing says: "When not waging warfare, the lord in his castle on crest or side of hill was bound into an intimate and strong relation with wife and children. They were separated from society, and compelled to find satisfaction and contentment in each other. This tended to place members of the family on absolute equality." However, in humble homes, among families without rank or reputation, degradation was developed through the abusive power of the lord over the wives of his dependents.

A most beautiful type of family life is seen at the beginning of our own country in colonial days. It is a revelation to watch the observance of that home amenity—the just consideration of each other—in the Winthrop family, as it grew into nine children and several faithful domestics, who always went to church with the family, and were buried in the family lot. It is as fascinating as a realistic novel, in the best sense of realism, to see them go from an old world to a new, under trying circumstances, yet remaining loyal to each other in enforced absences and exasperating losses. The postnuptial love letters of John and Margaret Winthrop are as fervid as the prenuptial. The eldest son in this family is like a younger brother to his father, sharing responsibility and labor with him, and always a noble stepson to his loving stepmother. The filial respect, the family government, the family economy, the family unity, the family simplicity, and withal the family hospitality, so sincere and generous as to include the soldier, the sailor, the farmer, John Eliot the missionary, the London lawyer, and the Oxford scholar, who are welcomed without fuss or fume to succotash, hominy, hasty pudding, pumpkin pie, and a feather bed, exhibit a type of family life that puts to shame a merely outward colonial home—a house—full of things, and empty of real lives.

After the picture of the "Governor's family," and the lapse of two hundred years, we may catch a glimpse of a famous social group whose influence has been felt throughout this whole century, in American literature, education, philosophy, and theology. Civil society, also, is largely indebted to that Litchfield family of Lyman Beecher, whose mandate—"Mind your mother! Quick! No crying! Look pleasant!"—was obeyed in military fashion. This household was pre-eminently cheerful, witty, literary, social, and free in its development. The growing young people were not uneasy to go somewhere every night, because the older and younger enjoyed and appreciated each other in delightful evenings at home, where con-

versation was educative, thrilling, and amusing, with true story and anecdote. The young Beechers had plenty of wholesome household and out-of-doors work during the day, so that to be with the family at night was as restful to them as evening basketball and feats on the trapeze in the gymnasium, away from the family, are to our young people. Their prayer meeting was "family prayers." Their literary club was a family affair. Their theater was a family affair with continual star additions in men and women from far and near, that gave and received large measures of profit and amusement, thus instituting a family reciprocity that has, finally, been copied by the family of nations.

The last turn of our kaleidoscope reveals a strangely contrastive picture that we have read about, if we have not seen. Let us hope that it is exceptional if true. The father in work-harness from January to January boards and lodges at the family residence, and pays all the family bills, when he is able to. If guests ever find him at home he seems to have "dropped in by accident," gives them a perfunctory handshake, says nothing, or something mechanically, and is at a loss how to behave generally. His son Jack, a little "unsteady," is conspicuous by his absence at his bachelor apartments. His wife, "jeweled like a Hindu idol," smiles, converses, and does the proper things—from chaperoning the young ladies to the opera to settling "quarrels below stairs." Sometimes the family—that is, the female portion of it—"passes years in Europe" for the health or deceptive veneering of daughters who may not know the names of half a dozen mineral springs in their own country, and who forget that the United States has a few cañons, a few mountains, a few universities, and a few art collections. Somehow, the management of this family has come to devolve on womankind. One writer makes the modern father "a hopeless victim, . . . forced into a style of living which exceeds his means and violates his tastes, forced to yield the guidance and discipline of his children to systems with which he has no sympathy, forced to these sacrifices by the relentless will of an elegant wife." Allowing that this last family picture is unusual and extreme, it is still plain to any keen observer that the pendulum has swung from excessive familism to a somewhat normal domestic life, and then outward to a riotous individualism that indicates family decline if not consumption. Among the most potential causes of this condition are:

1. Complexity of home architecture, furnishings, and personal wardrobe.

2. The apparent apathy, willingness, or submission of men, in yielding to women rights and privileges that belong to themselves.

3. The feverish desire for liberty at any cost.

4. Fewer marriages and more false marriages, with the ever-ready divorce escape.

5. The great and increasing opening in the economic world to female labor.

6. The unparalleled multiplication and popularity of clubs.

7. The willingness of outside institutions to assume functions of the family, and the readiness of the family to transfer them.

REMEDIES LIE IN CAUSES.—In the perplexing mizmaze of the modern residence, in the undue attention to the multiplex mysteries of the modern wardrobe, in the multiform engagements of the modern individual, the family is losing its identity. When some Ariadne puts into its hand the silver cord of *simplicity*, the family, if it holds on to the cord, will be helped back to its rightful place. Simplicity can not be adorned. It is a grace of itself, whether in a house, a face, or a gown. Simplicity will never entangle the family, so that one by one the individuals will want to extricate themselves and run away. If it is not desirable to return to white houses with right angles and green blinds, to the big kitchen with its big fireplace and crane—a kitchen where the family gathered for ciphering, and knitting, and apple-paring, and reading aloud, and "fox and geese," and blindman's buff, without a thought of "the carpet"—it is desirable that we make some kind of a rallying center where the family will feel free, comfortable, and communicative. Even the center table is being banished in some homes, and the easy settee and high-backed lounge have been superseded by a luxurious-looking couch, piled high with pillows, some of them pretty to look at, but often too dainty for use. Things merely "to look at" should be confined largely to walls, mantels, pedestals, and portfolios.

A partial reintegration of the family will take place when the house father stands for authority, judgment, and righteousness as much as the house mother for patience, tact, and love. In the animal world, with the exception of the birds, the fathers are nearly all family backsliders. In the human family, business and business worries have been excuses long enough for a man to leave family management entirely to his wife. Adam and Eve *together* were to have dominion over everything. No man has a choice of the family he is born into, but he is responsible for his own family, which he should never have established unless he chose to be the head of it, or one of its heads, and wisely co-operative in its development. No true father need to be "forced" into false family living. When he permits himself to be so forced he is a backslider.

Individual liberty along most lines means advance and advantage; but such liberty without becoming restraint, especially among mere boys and girls in the family, results in rebellion at home and

anarchy abroad. Individualism running riot is like a frenzied runaway horse that finally clears himself of every attachment. Before the individual thus runs away with himself, it might be a good thing in the United States, where there is such a general movement of liberation, to return to the family as the social unit. That the lack of individualism was the bane of the ancient family, and the excess of it is the bane of the modern family, shows that in both family and state "real liberty is neither found in despotism nor in the extremes of democracy, but in moderate governments."

There are those who think fewer marriages are due, among other things, to the fact that so many women are embracing the "higher education." It is true, such women are no longer satisfied with a husband who is merely a "good provider" of material things. But this is not ominous. Highly educated women crave companionship, but such as includes the intellectual and moral. Family life needs the leaven of a good intellectual heredity as well as physical. No amount of education will ever destroy maternal or wifely love in a true woman, illustrated in the case of George Eliot and our Margaret Fuller, who was never happy until she became the "*mia cara*" of Ossoli, and the mother of the blue-eyed Angelino. The man who, like Helmar in Ibsen's Doll's House, wants in a wife only a lark to sing for him, a doll in soft and silken gown to dress up his home with, will still frown on the higher education for women.

When one sees a bridegroom chewing gum during the entire marriage ceremony, and discovers six months later that the bride (the third wife) has secured a divorce, one concludes that quality of marriage is more essential than quantity. I heard a gentleman say, not long ago, that "one reason why more young men do not marry is because fathers do not set us an example in family happiness, nor look upon family happiness as a success to be won." False marriages, like those of Dorothea and Casaubon, Gwendolyn and Grandcourt, Andrea del Sarto and Lucrezia, occur because the seriousness of the marriage relation is not understood.

When parents, by example and precept, teach their children the sacredness of marriage, when clergymen are not so fast to tie the knot, and lawyers to untie it, the foundation for the family will be stronger.

Arthur Fairbanks, in his recent book, reasons that the economic problem concerns the family even to a greater extent than the divorce problem. He thinks when a woman is obliged to go into the factory or shop to eke out a husband's earnings, which have become smaller and smaller because men have come into competition with women willing to receive lower wages for the same work, the effect is deleterious upon the family. It is still more alarming when women,

simply because they dislike housekeeping and the "bother" of little children, put an inefficient or efficient substitute in the position of family care-taker, while they themselves accept a clerkship in the husband's or stranger's down-town office, under the subterfuge of earning more than enough to pay for the extra service at home. Assuming maternity and shirking motherhood is even more dangerous and condemnatory than assuming paternity and shirking fatherhood. I understand from our Commissioner of Labor, Mr. Carroll D. Wright, that 88.7 per cent of employed women are single. If this is not true, and the majority or even a large minority of women wage-earners are married, then it is a serious matter that may be regulated in some degree by sociologists and capitalists.

The writer is a member of two clubs that are stimulating and helpful to the primary social settlement—the family—and believes that a moderate use of the club, like that of any good thing, is desirable. But when the club is ubiquitous and disproportionately valued, so that men, women, and adult children "recognize themselves more by their badges," and care more for ties of ribbon than ties of blood, then the club is inimical to home life. The remedy for this is in making the family a fraternity—an enlarged fellowship of people and ideas, a comradeship, that shapes itself into forms of mutual helpfulness. When heads of families, who now entertain their gentlemen friends in elaborate, expensive ways of eating and drinking at their clubhouse, are free and willing to bring them to the family house, where eating and drinking shall be the subordinate part of a home welcome; when it is the custom of women to open the doors of their homes and hearts in retail hospitality, instead of disposing of social indebtedness in the lump, as it were, at their clubhouse; when the ornaments of a house are "the friends who frequent it" and the family who live in it, and when courtesy between the members of the family is as pronounced as that between club members; when family amusements are pleasant and recreative, the home will be as popular as the club. To avoid disintegration and disloyalty, the family must satisfy the reasonable desires of its individual members.

That very important family function of communicating psychical impulses is too often disused, abused, or transferred. When this function is in normal exercise,* the family conversation at table is not the same category of questions and answers as to individual tasks, or the familiar rehearsal of the grocer's blunders, the servant's inefficiency, or the children's mishaps.

* See An Introduction to the Study of Society. By Small and Vincent, p. 246.

The family is the original social group, the oldest school, and should not transfer its legitimate functions to the kindergarten, graded or high school. The kindergarten is unimpeachable in aims, if not methods. Public schools, in general, are something to be proud of. But the kindergarten is limited in its mission without family co-operation, and "the public school accomplishes but little, except when it supplements the intellectual life of the home." Perhaps the latest assumption of family functions in the school line is seen in the establishment of parental schools for incorrigibles, usually under the care of school boards. Not only are incorrigibles provided for by public institutions, but the sick, the aged, the infants, the imbeciles, and a legionary body of unfortunates. Benevolent and reformatory institutions must needs be, in moderation, especially for such classes as the blind, the deaf-mute, the insane, the orphan, and the homeless. But, as propagation is the exclusive function of the family, is not the family bound to do its best and its utmost for its own progeny? Are not families becoming too willing to roll off family burdens on to the state?

Even the religious training of children is willingly turned over to the church and Sunday school by families capable and responsible not only for laying foundations for the Sunday school to build upon, but for co-operating with the Sunday-school teaching. The Jewish church began in a family, and the Gentile church began in a family. Does the family pew in the meeting house show that the church is still in the family, or does it indicate family disintegration? If it does, there will be reintegration when fathers and mothers no longer look lonesome in the "family pew" because their children are scattered around in other pews, visiting with other people's children, or in other assemblies, or off on the road bicycling, and when children no longer look lonesome in the family pew because parents are "taking it easy" at home.

The aim of social settlements, like the Hull House, Andover House, Hiram House in this country, Oxford House, Mansfield House, and the teetotums in London, is to supplement family life, or, more correctly, to substitute something for nothing, or something good for something bad in the numerous and prolific families that barely exist in one room, two rooms, or three rooms in the rookeries of all great cities. This fact, together with the facts we have been considering, proves the family to be the social group first in importance, as well as first in order of being. And so we conclude that there is not only danger to society in the ill performance of family functions in "Mulberry Bend," New York; Drury Lane, Bethnal Green, and Spitalfields, London; in the two- and three-hundred-

years-old closes, wyndes, and laundes of Edinburgh and Glasgow; but also in homes on light and clean streets and famous avenues.

Obligations of society toward the poorest poor can not be lessened, but they can be increased toward the rich and the richest. "There is no duty of one class toward another which is not essentially the duty of each human being to all his fellows. There is no genuine charity toward the poor which is not, in principle, the duty of the rich toward the rich."

The art of living together domestically is a fine art, that seeks expression through beautiful family life which is not extinct, but comparatively rare. Along with renaissance, in architecture, painting, and sculpture, why may there not be a family renaissance, so that men, women, and children shall feel that the real life of the world is not in the counting house, clubhouse, schoolhouse, meeting house, courthouse, or statehouse, but in the family house—the dwelling house?

SKETCH OF CHARLES D. WALCOTT.

A "NEW YORK GEOLOGIST," whose name is not given, is quoted as having attributed Mr. Walcott's success largely to his having persistently followed one track. Acquiring a taste for geology when very young, it eventually became dominant, and more and more manifest to the world about him, till he secured a position in the United States Geological Survey. There he has risen, chiefly by the force of his ability and energy, to his present position of director of the survey.

His grandfather, Benjamin S. Walcott, moved from Rhode Island in 1822, and became one of the leading manufacturers of central New York; he had broad interests in educational matters, was the founder of a professorship at Hamilton College, and was well known as a philanthropist. His son, Charles Doolittle Walcott, was a man of unusual energy, was well established in business, and held an influential and leading place in the community. Dying at the early age of thirty-four, he left a wife and four children, the youngest, two years old, being the subject of this sketch.

CHARLES DOOLITTLE WALCOTT was born at New York Mills, N. Y., March 31, 1850. His scholastic education was in the public schools of Utica, which he entered in 1858, and in the Utica Academy, which he left in 1868. He then entered a hardware store as a clerk and, continuing in such occupation two years, acquired a practical business training, which has proved of great value to him.

His scientific tastes were developed at the age of thirteen, when

he became interested in collecting fossils and minerals. A few months afterward he met Colonel E. Jewett, geologist, paleontologist, and conchologist, from whom he borrowed books and received many suggestions, and through whose influence he became a student with method. Geological collecting and reading were continued during the remainder of his school life, and other scientific studies were also taken up. For two winters he devoted much time to optics and astronomy, and incidentally made large collections of insects and birds' eggs.

During the summer of 1867 a drift bowlder, accidentally broken by his buggy wheel, revealed to him fossil forms so different from those of the neighboring Trenton faunas that his interest was greatly excited, and in seeking to learn their origin and relations he was led to examine the literature of the pre-Silurian fossiliferous formations. He soon discovered that relatively little was known of them, and also that there was much confusion in the classification. It became his ambition to make a thorough investigation of all the pre-Trenton sedimentary formations and faunas in their geological relations, and in their relations to the development of life and the evolution of the North American continent, and this was later taken up as his life work in geology. His range of observation was also enlarged by excursions in Herkimer and Oneida Counties, where he met examples of Archæan and Glacial as well as Palæozoic formations.

In 1871 business took him to Indianapolis, where his scientific tendencies were further stimulated by Prof. E. T. Cox, who was then making a geological survey of the Indiana coal fields. The time now arrived when it seemed necessary to choose between a business life and a life of research. A partnership was offered him on favorable terms, and if he accepted its responsibilities little time would remain for study and investigation. If, on the other hand, he devoted his life to science, it was important that he secure more time for its prosecution than was consistent with his present business engagements. Deciding in favor of scientific work, he left Indiana and returned to the collection and study of Trenton fossils in New York.

While a schoolboy he had spent summer vacations on a farm near Trenton Falls, a region of great geological interest and peculiarly attractive as a collecting ground. On determining to follow a scientific life he returned to Trenton Falls and established himself on the farm of William P. Rust, where he arranged to do a certain amount of farm work, reserving the remainder of his time for his chosen studies. Here he remained five years, gathering a rich collection of local fossils, beginning their systematic study, and enlarging his horizon by extensive excursions on foot during the spring and fall.

His paleontological collections included a unique series of Trenton limestone fossils, which was sold in 1873 to Prof. Louis Agassiz, and his intercourse with Professor Agassiz at that time was most helpful and stimulating. An arrangement was made for Mr. Walcott to go to Cambridge and pursue a course of study under the advice and direction of the great naturalist, but this was frustrated by the death of Agassiz.

In November, 1876, he received his first official appointment, becoming assistant to Prof. James Hall, State Geologist of New York. While holding that position researches were made in New York, Ohio, Indiana, and Canada. In July, 1879, Mr. Walcott was appointed field assistant in the United States Geological Survey, then under the direction of Clarence King, and was assigned to the study of the great geological section extending from the high plateaus of southern Utah to the bottom of the Grand Cañon of the Colorado. In 1882 he collaborated with Mr. Hague in the survey of the Eureka mining district of Nevada. The Palæozoic paleontology of the survey was now assigned to him, and, though this entailed considerable routine work in the identification of fossils brought from many fields by the various geologists, he was enabled to pursue with vigor his cherished plans for the investigation of the older faunas. He examined the Cambrian formations of the Appalachian belt all the way from Alabama to Quebec, and carried his researches on a more easterly line through New England and New Brunswick to Newfoundland. He also began a series of western studies which eventually included the most important known bodies of Cambrian rocks in Texas, Arizona, California, Idaho, Nevada, Montana, Wyoming, and South Dakota. In 1888 he was advanced to be paleontologist in charge of invertebrate paleontology in the Geological Survey; in 1891, to be chief paleontologist; and in 1893, to be geologist in charge of geology and paleontology, in which capacity he had charge of the general direction of that branch of the work of the survey. In July, 1894, Major J. W. Powell, after fourteen years' service as director of the survey, retired from that office, and Mr. Walcott was selected by President Cleveland to succeed him.

Mr. Walcott's service to science falls under two heads—research and administration. The scientific study which results in positive additions to the world's knowledge has a somewhat definite course, beginning with the observation of phenomena, proceeding with their arrangement in classes, and concluding with hypothesis and theory as to their natural sequence or genesis. Classification and hypothesis afford new points of view which lead to additional observations, so that the various steps of the process are to a certain extent alternated; but the most successful researches, those whose results

are of a permanent character, begin with a broad foundation of observation. The work that begins with theory and afterward seeks for verification through observation may be brilliant and attractive, but its results are rarely of lasting value. Mr. Walcott's scientific work has followed the normal and conservative course, beginning with the prolonged collection of specimens and other facts, following with generalization, chiefly in the field of the correlation of formations, and leaving largely to the future conclusions as to sequence and genesis.

His paleontological studies have been of two classes: biological, viewing fossil organisms as members of the animal kingdom, and stratigraphical, viewing associated fossils or faunas as the representatives of contemporaneous life and the labels of synchronous formations. His biological labors include the description of a considerable number of new families, genera, and species of Palæozoic invertebrates, and an elaborate study of the structure and organization of trilobites, which has served to give them, for the first time, a definite and unquestioned position in the systematic scheme of animal forms.

The trilobites were dominant forms in early Palæozoic time, and continued, with diminishing numbers and importance, until the Carboniferous period. Exhibiting a considerable range of differentiation, they have been of great service for the classification of terranes, and the nomenclature of the Cambrian horizons has been based upon them. Nevertheless, their systematic affinities were long in doubt, because they were known only through imperfect specimens, exhibiting the dorsal armor, but showing no trace of appendages for locomotion, respiration, etc. From time to time the discovery of legs and other members had been announced and subsequently disproved, and geologists had become so skeptical as to the possibility of their determination that when traces of a leg were actually discovered by E. Billings, in 1870, little credit was given to the announcement. Here was an important biological blank to be filled, and Mr. Walcott, at the suggestion of Louis Agassiz, undertook to fill it. The examination of thousands of trilobite specimens perfect as to the carapace revealed but a few traces of organs, and it was found that those traces all came from a certain layer of Trenton limestone only a few inches in thickness. That layer was carefully quarried over a considerable area, even though it became necessary to remove several feet of superjacent strata. Several thousand complete tests were obtained from it, and two hundred and seventy of these were found to contain some of the missing members in greater or less perfection. To such specimens elaborate study was given, chiefly by means of translucent thin sections, such as are employed by the petrographer. With their aid, and through prolonged labor and study, Mr. Walcott

was enabled to restore and delineate all the more important organs, and thus make a satisfactory determination of the biological rank and position of the *Trilobita*.

In stratigraphical paleontology Mr. Walcott has thoroughly combined field studies of the strata with laboratory work on fossils. His most important local work has been on the so-called Grand Cañon section of Utah and Arizona, which exhibits an unusually complete rock series from Archæan to Tertiary, in the Eureka mining district of Nevada, and in the Taconic region of New York, Vermont, and Massachusetts. His work on the Cambrian formations of North America covered a wide geographical range, as already mentioned, and led to the systematic grouping of the Cambrian rocks in three chronological divisions, each characterized by a distinctive fauna. In 1888 he visited Wales for the purpose of making a personal study of the type district of the Cambrian system—the district rendered classic by the original labors of Sedgwick and the subsequent researches of Hicks.

Mr. Walcott's work of scientific administration began in 1891, when he was given supervision of all the paleontological work of the Geological Survey, and has been progressively enlarged to the present time. When called to the directorship of the survey in 1894, he took charge of a body of scientific work already well organized, and continued a policy of administration which for several years he had been instrumental in shaping. He had no important changes to institute which had not been contemplated by his predecessor in office, and his ability to develop and strengthen the organization depended largely on the confidence he was able to inspire in those members of the legislative branch of the Government who determine the amount and general purpose of appropriations. Between 1879 and 1894, while the survey was under the direction of Mr. Clarence King and Major J. W. Powell, the amount assigned by Congress to its work had been gradually enlarged from $106,000 to $459,640, and the great body of geological work thus rendered possible had so stimulated State and individual activity as to give American geology a new and unprecedented status. Not only did the publications of the survey constitute a library in themselves, but the valuable material which became available for unofficial publication led to the institution of two journals devoted wholly to geology, and the organization of a geological society publishing annually a large volume of Transactions. It was therefore a matter of great importance, alike to the science of geology and to the great economic interests involved in its development, that the man chosen to succeed Major Powell should command the respect and confidence of the people and their representatives, so that the national work

which had proved so fruitful and stimulating might be continued and enlarged. The event has proved the wisdom of President Cleveland's selection, for each successive Congress has increased the appropriation and enlarged the function of the survey.

A comparison of the appropriations for the current fiscal year with those made for the fiscal year 1894, just preceding Mr. Walcott's accession to the directorship, shows enlargement in many directions. The various items providing for the geological work proper, and the work in paleontology, chemistry, statistics, etc., show an increase of $22,000, besides an item of $50,000 for hydrography, which was not separately recognized in the earlier bill, although the work had then been initiated.

The body of work to which the title of hydrography is applied consists in the determination of existing water supply, both in streams and underground, and in the discussion of the economic availability of this supply for agricultural, municipal, and other uses. The importance of such work to agriculture and sanitation, and the need of investigation under national auspices, have been recognized for some years, but there has been doubt as to the particular bureau to which the research should be intrusted, and the responsibility has been shared at various times by the Geological Survey and the Department of Agriculture. It is now lodged wholly with the Geological Survey.

From the year of its organization the Geological Survey has performed a large amount of topographical work, making maps on which are shown not only roads, towns, streams, etc., but the shape of the surface. For a much longer period the United States Land Office has been engaged in surveys for the purpose of dividing the public land into townships, sections, and minor cadastral divisions, as a basis for transfer to individual settlers. The two works have to a considerable extent covered the same areas, but the purposes and methods of work were so different that for a long time it did not seem practicable to unite them. Recently, however, an extensive experiment has been made in that direction. The bills appropriating money for the land surveys have been so phrased as to permit the Secretary of the Interior to have part of the work done by the Geological Survey, and the experience of three years, involving the expenditure through the survey of about $400,000, has shown that by using the administrative methods of the Geological Survey the two works can be carried on conjointly with less cost than was formerly found necessary for the cadastral surveys by the Land Office alone. For the present fiscal year the sum of money thus assigned to Mr. Walcott's direction is $241,500.

Long agitation with reference to the waste of timber on the pub-

lic domain, and the danger of a timber famine in the future, have led to the institution of a number of forest reservations, and in the last year of his administration President Cleveland established, by proclamation, thirteen additional reservations. Under existing laws a vast body of land included in these reservations could not be utilized for agriculture or town sites, and the exclusion of settlers from so great a domain led to vigorous protest. The situation involved considerable strain, and there was danger that the attempt to protect the forests would fail; but a compromise was finally arranged, under the terms of which the Geological Survey was instructed to map the reservations, marking upon them the areas actually forested, and also the areas available for agriculture. One hundred and fifty thousand dollars were appropriated for this work, and another important duty was thus imposed on the survey.

The survey is also charged this year with the running of the northern part of the boundary line between Idaho and Montana.

Thus in four years three new functions have been given to the Geological Survey, and the sum of money intrusted to Mr. Walcott's administrative care has been enlarged from $484,640 to $967,840, an increase of more than one hundred per cent.

The individual who demonstrates high administrative quality by success in any one field is sure to find opportunity for its exercise in other fields, and Mr. Walcott has been no exception.

The death of Dr. G. Brown Goode, in the fall of 1896, had made vacant the office of assistant secretary of the Smithsonian Institution and director of the United States National Museum. The position is one that requires a rare combination of qualities. For this reason, and on account of the intrusion of outside issues into the matter, the secretary of the institution found the selection of a person to fill it difficult. It was offered to Mr. Walcott, but he declined to leave the Geological Survey. He finally consented to take the place temporarily, with the understanding that his duties should be confined exclusively to the charge of the museum; and this proposition being accepted by the Board of Regents, he now holds the position of acting assistant secretary of the Smithsonian Institution in charge of the National Museum.

Mr. Walcott is one of the younger members of the National Academy of Sciences, to which he was elected in 1895. In the same year the Bigsbee medal of the Geological Society of London was given him in recognition of his distinguished work as paleontologist and stratigraphical geologist. This medal is awarded biennially "as a recognition of eminent services in any department of geology, irrespective of the receiver's country," and Mr. Walcott was the fourth American to receive it.

Editor's Table.

EDUCATION AS A FACTOR IN EVOLUTION.

AN ingenious but somewhat paradoxical writer of the present day has lately said that, "were we all agreed as to the training of our children, we need not await the slow evolution of the social millennium; it would be achievable in the very next generation." His argument is that "if a generation can be reared to reverence a stick or a stone, an inanimate idol, and this or that grotesque religious system, it can be reared also to love and reverence man." The postulate here, it will be observed, is a very extensive one—"were we all agreed as to the training of our children." The meaning evidently is, that if our intellectual methods and moral principles were in complete accord, and if both were of the most advanced order, we might look for the speedy coming of the millennium. Why not? We should be all but in it ourselves, and when it came our children would hardly know the difference.

It does not seem to us that there is much advantage in this way of stating the case. We are *not* all agreed as to the training of our children. We are agreed, broadly speaking, in some things; but, unfortunately, the things we are agreed upon do not make very directly for the millennium. In the matter of education there is no opinion so widely shared or so strongly held as that education ought to be mainly a preparation for commercial success. It was said long ago that wisdom was "the principal thing," and that therefore we should get wisdom. That opinion has been before the world for some thousands of years, but it has never yet dominated the mind of any society; and to-day, as much perhaps as ever, the feeling of the multitude is that money is the principal thing, and that therefore every effort should be bent on getting money. Apart from the teaching of school there is the teaching of daily life. Here again the most widely entertained ideals are not the best. The methods, for example, of the politician may almost be said to be imposed on him by the people. If the path to political success lay through a careful study of public questions with a view to the general good, our politics would be completely transformed and a new race of men would appear upon the scene. But the idea of the general good as a paramount object is one which, in the present state of our civilization, can not be brought home to many minds; and the fact that it is repudiated by the multitude renders it difficult for those who acknowledge and accept it to act on it in a consistent manner.

The writer we have quoted, Mr. Archdall Reid,* thinks that, because a generation can be educated to worship a stick or a stone, one might just as easily be educated to "love and reverence man." Well, as we have already suggested, if the preceding generation loved and reverenced man, its successor would probably do so also, and possibly in a slightly increased degree. But that is not to the purpose; the question is, whether the present generation, being what it is, could as easily train the next into all the virtues required for the millennium as a given tribe of savages might train its children to believe in

* See his article, Characters, Congenital and Acquired, in Science, December 24, 1897.

and perpetuate its own superstitions. To ask such a question is to answer it. Fetichism is a phenomenon which has made its appearance in every quarter of the world, and which belongs specifically to a certain stage of the human mind. It has its roots very deep in human nature, and we may be allowed to doubt whether those roots are entirely dead in any human being to-day. Certainly we see stray shoots springing up from them in the very heart of civilization. The most prosaic of us will conceive singular attachments for various inanimate things of no special intrinsic value. We say we prize them for their associations; but that is only another way of saying that *something* has attached itself to those objects which, *for us*, changes their character and gives them a certain human or, as we might say, spiritual interest. One of the sanest of English poets, Wordsworth, has given expression in more than one passage of his works to this sentiment. As to any intellectual difficulty involved in attaching sanctity to a stock or a stone, it would be little felt by a savage; but, so far as felt, would probably be an aid to the maintenance of the cult. Over a century and a half ago it was remarked by the philosophical Montesquieu that, "by the nature of the human understanding, men like, in the matter of religion, whatever supposes an effort, just as, in the matter of morals, they like, speculatively, whatever bears a character of severity."

It is clear, therefore, that to hand on a fetichistic worship nothing is necessary beyond the ordinary, spontaneous action of the tribe; and it is equally clear, we imagine, that to bring on what is popularly spoken of as the millennium in the generation in which our children will be the chief actors would require nothing short of a miracle. We are not millennial people ourselves, and no determination to which we could possibly come in regard to the education of our children could have the effect of throwing them forward in moral development more than one generation. A tree may in a favorable year make a little more growth than in an unfavorable one; and a river may, in a year of unusually heavy rains, carry down more alluvium to an estuary than is carried down in an ordinary year. Thus we may conceive that a little more work for civilization may be done in one generation than in another; but any such variation will be confined within limits somewhat analogous to those which obtain in the purely physical region.

At the same time the problem of education is one deserving of the most earnest attention of all who are interested in social progress. Education is the debt of each generation to its successor, and, if we can not place those who come after us on a better footing than ourselves, we should at least see that we transmit an undiminished heritage. The aim should, of course, be—and among all but the most thoughtless, no doubt, is—to give those who come after us a better start than we had. The progress of science is doing wonders in the way of improving the surface of the earth; but the only progress which really makes for happiness is that connected with advancing ideals and better principles of action. Will the next generation enter upon active life with a higher conception, on the whole, of that in which the true value of life consists than we had at the outset of our career? It will be well if it is so; but it sometimes seems as if the most strongly marked characteristic of the next age would be a keener appetite for pleasure. If so, that is not progress. The late poet laureate of England

has told us in words which may be hackneyed by frequent quotation, but which can never lose their truth, that

> "Self-reverence, self-knowledge, self-control—
> These three alone lead life to sovereign power."

Modern state education can hardly recognize such a sentiment as this; but it must be recognized somewhere, or else we shall go backward, not forward. If every generation faithfully gives of its best to the generation that follows after, progress will be continuous and the equilibrium of society will be secure; but if at a given moment we begin to trust to governmental machinery and external forms and the general framework of laws to sustain the moral life of society the result will be disastrous. There is no life in these things. The poet moralist of ancient Rome had found this out when he exclaimed, "What are empty laws worth, unsupported by the moral sense of the people?" What is wanted is a deepened popular consciousness of certain commonplace moral principles—principles as old as the beginning of civilization, and yet which can not be held to, even in our own day, without an effort. To inculcate these is something very different from inculcating a system of fetich-worship; but it is the appointed task of the parents and teachers of to-day, and one which can not be neglected without grave responsibility.

SUBCONSCIOUS IMPRESSIONS.

AN interesting little book published by Dr. Louis Waldstein, under the title of The Subconscious Self, contains many hints that should be of use not only in the education of children, but in the general guidance of life. What the author principally shows is that the larger, and perhaps the more important, part of each person's character is made up of habits, tendencies, preferences, aversions, moods, and principles of which for the most part the individual has little distinct consciousness, and that these at critical moments have often a decisive effect on his destinies. The recognized business of education is to cultivate the consciousness of the individual, and to furnish him with such a working capital of knowledge, ideas, and mental and moral habits as may enable him to do business, in the widest sense, in the world as it exists to-day. But what is thus by direct educative effort brought into a man's consciousness may not penetrate very deeply into his nature. It may, to a considerable extent, be a mere external equipment, and the real man may have been molded and stamped by circumstances and influences of which neither he nor his educators took much or any account.

The more we reflect on this the more we shall recognize both its truth and its importance. Parents sometimes wonder why the multiplied precepts which they bestow upon their children do not more powerfully influence their conduct. The fact is that the precepts in question go to form in the children's minds a fund of conventional opinions—those which they will use before the world—but the parents' own example, the thousand and one ways in which they practically manifest themselves, are subconsciously received by the children and go to form the underlying character from which most of their actions spring. Hence the common maxim that example is better than precept. Precept strikes the consciousness, but example constantly present sinks into the heart.

In every department of life we see only too frequently a very wide

separation between profession and practice. Profession comes from the region of the conscious, and practice largely from that of the subconscious. Of course, many actions, and particularly our most public ones, are dictated by the active consciousness; but those that make up the main tissue of our lives have their springs in a deeper region and furnish a better index to our true selves. It is of the highest importance, therefore, that the young should not only receive formal instruction in right principles, but that their habitual surroundings should be such as to promote the general health of the moral and intellectual nature. They should see as little as possible of angry passion, of selfish scheming, of duplicity in any form; and every effort should be made to lead them to appreciate and enjoy the finer and happier effects of Nature and all that is harmonious and elevating in the world of art and of human effort generally. It may be said that this would give them an incorrect idea of the world as it is; but it should be borne in mind that the object is to make the world other than it is—to make men and women more humane, more reasonable, more equitable, to endow them with more correct perceptions in all matters of taste, and fit them for a higher plane of social life. If we were to proceed upon the assumption that the world is incapable of amendment, and that the only thing is to make ourselves at home in it exactly as it is, there would be an end to all progress in education.

There are some good remarks in Dr. Waldstein's book about the danger of crowding too much into consciousness and so impairing the subconscious receptivity of the whole nature. We have all heard of prodigies at school who have turned out very dull men in after life. As long as it was a question of absorbing the formal instruction imparted by masters, such individuals were far to the front; but afterward, when it came to be a question of individual resource, of energy, initiative, originality, they relapsed into quite a commonplace if not inferior position. It is very undesirable that anybody should be all consciousness. It is Shakespeare who says:

> "If springing things be any jot diminished,
> They wither in their prime, prove nothing worth."

In our schools many a "springing thing" is thus "diminished" through the very forcing which seems at the time to produce so great an enlargement of mental faculty. The careful educator should be constantly asking himself the question, Is the mind before me getting into contact with *things*? and his chief effort should be to establish and promote this contact, so that the mind may draw instruction from its surroundings as a plant derives nourishment from the soil. There is nothing absolutely new in Dr. Waldstein's views, because ages ago men recognized the comparative futility of brilliant faculties unsupported by solid qualities of mind and character; but he has brought forward what he has to say at a very good moment, when, almost more than ever, we need the quiet teachings of Nature to curb our mental restlessness and enable us to "see things steadily and see them whole."

Scientific Literature.

SPECIAL BOOKS.

In its multiplicity of anecdotes this study of sleep* resembles the early works of Ribot, and the author chats about each in an equally charming and irresponsible fashion. She is not chary, however, of generalizations, and a very limited number of examples suffices for wide inductions. In the regions of physiology and hygiene she gives a careful account of the phenomena of sleep, supplementing these with valuable suggestions of her own. It is only when she enters upon the pathology and psychology of her subject that she betrays herself as one of that school, mostly French and Italian, which may be called the romancers of science.

She laments that we understand so little about sleep, which absorbs one third of our lives. The extensive bibliography added to each chapter would seem to disprove a want of scientific attention. The circulation in the brain during sleep has been observed in animals by substituting a watch glass for a portion of the bone of the skull. Experiments have shown also that a withdrawal of blood from the brain precedes sleep, and all conditions tending to this result produce sleep. Heat or excessive cold, which draws the blood to the skin, is followed by drowsiness, and this is likewise the consequence of digestion which summons the blood to the large abdominal vessels. Debility and great loss of blood also cause cerebral anæmia and somnolence.

If it be inquired what is asleep within us, we find that it is only a part of the brain. It is possible for all the organs of the body to be active during sleep excepting partially the nervous system. The voluntary muscles are awake, also the sensory nerves and the cerebral centers controlling each. Only because the different nervous channels are sensitive is it possible to arouse a sleeping person. The author considers that the fact of being able to awake at a given time proves that the attention and will preserve their activity. After investigating the many hypotheses in regard to the causation of sleep, the conclusion is reached that sleep is the resting time of consciousness.

The pathological modifications of sleep embrace weakened and excessive activity. Complete insomnia is found only among the insane or extremely anæmic. Intermittent sleep is injurious, since there is not time in the fugitive rest obtained for adequate nutrition of the tissues. Partial insomnia is met with in persons who are liable to a flow of blood to the brain and those with unbalanced and irritable nervous systems. It is also the result of mental overstrain or extreme physical fatigue. On the other hand, excessive sleep has its attendant evils—the gradual weakening of consciousness and the mental faculties, and the production of serious physical disorders. Among rarer forms of pathological sleep the author discusses narcolepsy, latah, hypnosis, and somnambulism.

The hygiene of the subject brings up interesting questions. How much time should be given to sleep? What should be the light, temperature, and ventilation of the bedroom? Should habit control us? It is contended

* Sleep: Its Physiology, Pathology, Hygiene, and Psychology. By Marie de Manacéine. New York: Imported by Charles Scribner's Sons. Pp. 341. Price, $1.25.

that too great uniformity proves injurious. Much attention is bestowed upon the hypnagogic condition or state of half-awakening; connection is found between this and some states of mental aberration, and it always denotes a weakened consciousness.

The point of view taken in examining the psychic life of sleep is that "the subjective method is of the first importance." Another divergence from scientific habit of thought is that "in attempting to explain facts by chemical affinity we still have to explain chemical affinity itself." Observations made by the author during five years on thirty-seven persons convince her that dreams increase with the variety and activity of intellectual life. The studies of an Italian investigator show that idiots rarely dream, criminals dream seldom and but little, the greatest criminals least of all. Whence she concludes that it is only under morbid conditions and among the uneducated that it is common to find an absence of dreams. Not only are the dreamless thus condemned to a low intellectual plane, but "old age comes on more swiftly in those who dream little."

Prof. *J. Mark Baldwin's Social and Ethical Interpretations in Mental Development** is a continuation of the studies in genetic psychology begun in the Mental Development of the Child and the Race. It is, however, independent of that work except in so far as the natural connection requires somewhat frequent reference to it. In view of the lack in English of a book on social psychology which can be used in the universities in connection with courses in psychology, ethics, and social science, the author has also endeavored to make his essay available for that purpose. This has led to such expansion of the fundamental ideas of the treatise as seemed necessary to a fairly complete working out of the social element in connection with each of the great psychological functions. The first part is, therefore, as far as its topics are concerned, a more or less complete study of social and ethical philosophy. The special object of the essay is to inquire to what extent the principles of the development of the individual mind apply also to the evolution of society. The study, therefore, falls into two main inquiries: What are the principles which the individual shows in his mental life—principles of organization, growth, and conduct; and what additional principles, if any, does society exhibit in its forms of organization, progress, and activity? Of the three methods by which the author conceives the subject may be investigated, he chooses what he calls the *genetic*, or that "which inquires into the psychological development of the individual in the earlier ages of his growth for light upon his social nature, and also upon the social organization in which he bears a part." The evidence is drawn largely from actual observation of children, and the main thought is the conception of the child's sense of personality. This is developed in Book I, which presents the person in public and private, as imitative, self-conscious, social, and inventive; his equipment, with instincts, emotions, intelligence, and sentiments; and his personal and social sanctions. The second book relates to society—the person in active and social organization—the social forces, social matter and process, and social progress. From the whole are deduced practical conclusions and rules of conduct. Some of the chapters in the second book

* Social and Ethical Interpretations in Mental Development. A Study in Social Psychology. By James Mark Baldwin. New York: The Macmillan Company. Pp. 574. Price, $2.60.

were written with reference to a question set by the Royal Academy of Denmark with reference to the possibility of establishing for an individual isolated in society rules of conduct drawn from his personal nature, and the relation of such rules to those which would be reached from a consideration of society as a whole. These chapters were crowned with the gold medal of the academy.

The lectures with which Sir Archibald Geikie inaugurated the Williams lectureship in Johns Hopkins University, have been published in a book which can be read with unmixed pleasure, entitled *The Founders of Geology.** In choosing his subject the author was moved by the thought that as his audience would include geologists from all parts of the continent and representing all departments of the science, a general topic of equal interest to all would be the best to present, and that a review of the past, with its successes and its errors, would afford valuable lessons in the future prosecution of the science. Yet it would be impossible to present the whole, even of this one phase of geology, adequately in a single course; and he therefore selected a limited period—that between the middle of the last century and the close of the second decade of the present one, an interval of about seventy years—a period which witnessed the laying of the foundations of geology. Even the whole of this period can not practically be fully covered, wherefore the author limits himself to the recital of the story of a few of the great pioneers, from whose "struggles, their failures, and their successes," it may be indicated how geological ideas and theories gradually took shape. The first chapter treats of the cosmogonists and the beginnings of accurate and detailed observation regarding the earth's crust and its history, with special notice of Guettard and his labors; then the rise of volcanic geology and geological travel, the history of the doctrine of geological succession, and the rise of the modern conception of the theory of the earth and of experimental geology are discussed, with notices of the leading names connected with each phase, closing with an estimate of the influence of Lyell and Darwin. From the whole the three lessons are derived of the varied employments of the most eminent leaders of the science and the small number of "professional" geologists among them; the length of time that may elapse before a fecund idea comes to germinate and bear fruit; and "the absolute necessity of avoiding dogmatism" in geology.

The existence of a rule based on astronomical considerations in the orientation of important buildings was suggested to Mr. Norman Lockyer by the observation of the direction in which the Parthenon is built, and of the many changes in the direction of the temple at Eleusis. Then he was reminded of a tradition that the eastern windows of properly constructed churches in England generally face the place of the sunrising on the festival day of the patron saint. He was thus set upon an inquiry which has been pursued for many years as to whether this is not a veritable rule, handed down from remote antiquity, and exemplified generally in temple architecture. The result of these inquiries is his book, *The Dawn of Astronomy.*† The richest field for such a study was of course found in the

* The Founders of Geology. New York: The Macmillan Company. Pp. 297. Price, $2.

† The Dawn of Astronomy. A Study of the Temple Worship and Mythology of the Ancient Egyptians. By J. Norman Lockyer. New York: The Macmillan Company. Pp. 432. Price, $3.

ancient Egyptian temples; but the illustrations of the author's theory are drawn, besides these, from several other sources. The determination of the stars to which some of the Egyptian temples, sacred to a known divinity, were directed opened the way to a study of the astronomical basis of parts of the mythology—which, however, the author has wisely left to the Egyptologists to follow up. The essay begins with a review of the astronomical knowledge and ideas of the Egyptians as disclosed in their inscriptions and emblems. An attempt is then made to show that they would learn to pay special regard to certain stars and their heliacal rising as connected with their seasons, and, as they advanced in knowledge, to the equinoxes and solstices.

A study is made of six Egyptian temples which were apparently oriented with reference to the solstices, with a detailed study of the great temple of Karnak. Attention is next given to temples which appear to have been placed with reference to certain stars, in which the change of apparent position occasioned since the temples were built by the precession of the equinoxes has to be considered. Many such temples are found directed to several stars. As connected with these coincidences and essential to their rational explanation, the association of these stars with the gods of the temples is discussed, and this brings in questions of mythology, the origin of the constellations, the zodiac, sun worship, the schools of astronomy, etc. These features are compared with *data* of the Babylonian astronomy, and the origin of the whole is sought. The book is curious and suggestive, and can not fail to be helpful to all students of ancient man and the beginnings of science.

GENERAL NOTICES.

In *Hallucinations and Illusions** the fallacies of perception are studied by Mr. *Parish* in the light of the data furnished by the International Census of Waking Hallucinations of the Sane. While examining the books on the general subject the author found that, as a rule, only single aspects of it were treated, such as fallacies of perception occurring under morbid conditions or in dreams, while little or no attention was given to the waking hallucinations of healthy persons; in fact, very few data had been collected to furnish the basis for an inquiry into this aspect. The requisite data have now been obtained by the International Congress of Psychology, and the subject has undergone some discussion in that body; and it has seemed a good time to review, as a preliminary inquiry, the whole field of sensory delusion, to indicate its relations to normal or "objective" perception, and to elucidate the common organic principle which underlies alike normal and fallacious perception. This is what is undertaken in this book. Fallacious perception is considered as affected by various pathological and physiological states, and, as to the physiological process in it, its factors, contents, initiation, and manifestations, with a summary, an appendix containing narratives of waking hallucinations collected by Baron von Schrenck Notzing, tables compiled from the censuses, and indexes of authors and subjects.

For the student of Nature's humbler efforts in the mammalian line, Mr. Ingersoll's series of sketches * of the habits and ways of some of our commoner "wild neighbors" will prove instructive as well as delightful reading. The author is a well-known contributor of natural-history papers to the magazines, some of the chapters in this volume in fact being made up in part from material

* Hallucinations and Illusions. A Study of the Fallacies of Perception. By Edmund Parish. New York: Imported by Charles Scribner's Sons. Pp. 390. Price, $1.25.

* Wild Neighbors. Outdoor Studies, in the United States. Illustrated by Ernest Ingersoll. New York: Macmillan & Co. Pp. 297. Price, $1.50.

which has previously appeared in this way. The greatly added interest and pleasure which the merest smattering of natural history gives to out-of-door rambling is not generally appreciated, and if Mr. Ingersoll's book has no other result than that of pointing the way for some amateur scientists into a field of almost inexhaustible variety and beauty it will amply justify itself. There are nine special animals and their families described, the first place being given to the squirrels. The puma or American panther, under the title of The Father of Game, is given a long chapter. An exceedingly interesting but somewhat unusual section in such a book is entitled The Service of Tails, and describes the various useful purposes served by this appendage. Among the forms discussed perhaps the most curious is that of the opossum, which serves both as a "hand rail for the young family" and as a fifth limb for the mother. Another strangely useful tail is that of the king crab or horseshoe. It is used as a pry or lever, and seems quite essential to the preservation of the life of its owner. The hound of the plains, or American prairie wolf, is described in the fourth chapter. Other animals taken up are the badger, porcupines, the skunk, "calmly considered," woodchucks, and "coons." The sketches consist mainly of descriptions of appearance, habits, and food, with whatever of anecdote or fable the author may have found clustering about the animals among the Indians or elsewhere. The illustrations are fairly good.

Mrs. *Frank's* adaptation of Hauschmann's *Origin and Development of the Kindergarten System** is not strictly a translation, but rather an account of the contents of the book, with such omissions, curtailings, and transpositions as seemed necessary to render the material practically useful to kindergarten students and others interested in the training of young children. Her work has been done under the impression that no other book in kindergarten literature presents so complete an account of the progress and development of Froebel's educational thought. "It shows what kind of a man Froebel was, and how he came to elaborate his system, and is made the medium for tracing the growth and development of the Froebel idea from its very beginnings down to the establishment of the first kindergarten." The translation has been made with Mr. Hauschmann's permission, and he has assented to the changes the translator has thought it proper to make. The curtailments consist chiefly in making as short as possible the account of certain periods in Froebel's life already in the hands of the English reader, and in summarizing some of the passages.

It does not take the serious student of French literature long to learn that it is very large and various. Much of it is also very brilliant. Each of the periods, from the middle ages down, into which criticism classifies it offers its store of books, than which no other literature exhibits a fuller one, and is distinct in its characteristics; while in every department, except poetry, it possesses works which are not excelled. A suitable and well-adapted presentation of the subject, such as Mr. *Dowden** gives us, can not fail, therefore, to be a valuable and in every way desirable addition to the library of manuals. For making such a presentation the author confesses to having the most essential qualification—love of the subject. Thorough acquaintance with the whole of it he can not have, for that is beyond the power of any one man, and he especially observes that the latest attempt at its full presentation is the combined work of specialists, of whom there is one for each chapter. He, too, has had his collaborators, "the ablest and most learned students of French literature," who have written each a part of the book; but he has consulted them, not in the flesh, but on the shelves of his library. Five periods are recognized, with subordinate classifications by forms, etc.—the middle ages, of which the amount of production that has survived is astonishing; the sixteenth century, the seventeenth century, the eighteenth century, and the period from 1789 to

* The Kindergarten System: Its Origin and Development, as seen in the Life of Friedrich Froebel. Translated and adapted from the Works of Alexander Bruno Hauschmann for the Use of English Kindergarten Students. London: Swan, Sonnenschein & Co.; Syracuse, N. Y.: C. W. Bardeen. Pp. 253. Price, $2.

* A History of French Literature. By Edward Dowden. New York: D. Appleton and Company. (Literatures of the World Series.) Pp. 444.

1850. The work closes with the decline of the romantic movement, leaving the naturalism of the present rather a subject for current criticism. Provençal literature is not included. The index is commendably full.

The *Bibliography of Education** is the outgrowth of an educational library which the author, *Will S. Monroe*, of the State Normal School, Westfield, Mass., has been collecting for sixteen years. When, a few years ago, he undertook to catalogue the collection, then numbering about twelve hundred volumes and pamphlets, with a view to publication for the benefit of other persons engaged in educational work, it was thought best to enlarge the list and include other works bearing on the subject. The present catalogue, the resultant of this idea, contains the titles of thirty-two hundred books and pamphlets, nearly all in the English language and obtainable in the ordinary course of trade. The exceptions to this rule are works of reference—encyclopædias and bibliographies, which are also included. The standard foreign works of reference are given, and sources of information are indicated respecting the educational literature of France and Germany. As much care has been taken to secure titles of English books as of American. The indexing of periodical literature is not attempted. The titles are grouped into classes, and these broken into sections and subsections, the shape of which has been largely controlled by the nature of the materials, and an index of twenty pages is provided.

Prof. *Sylvanus P. Thompson's Light Visible and Invisible*† is a work of real popular interest, and at the same time presents in its appendices to chapters brief discussions in exact science. It embodies the Christmas lectures delivered by the author to the people at the Royal Institution in 1896, which were liberally supplemented by experiments, and in which pains were taken to present the most recent progress in science. The wave theory is kept in special prominence, and the language is adapted to it. In the lecture relating to the invisible light of the infra red some of the experimental points on which the demonstration of the electro-magnetic nature of light rests are introduced. Having learned by his experience that polarization is not hard to understand when properly explained, the author has presented the subject "in a model way, devoid of pedantic terms, and illustrated by appropriate models." The topics treated are light and shadow, the visible spectrum, and the eye, polarization, the invisible spectrum of the ultra-violet and the infra-red, and Röntgen light. Interference and diffraction are barely alluded to, and spectrum analysis and the greater part of the subject of color vision are necessarily omitted. In the appendices to chapters the general method of geometrical optics, anomalous refraction and dispersion, the elastic solid, and the electromagnetic theories of light are briefly explained, and "other kinds of invisible light" are described or mentioned.

To the man who speculates on the origin and ultimate goal of the human race—and who of us does not?—the geological periods when we first begin to find evidence of man's existence in anything like his present form can not fail to be of exceeding interest. The treatment which the human society of these remote days usually receives is not of a popular character, although it is frequently closely allied to pure fiction. But now Mr. *Stanley Waterloo* has given us a novel* whose plot is laid in the time of the cave men, the earliest period from which any human remains have been obtained. The hero of the story, Ab, is one of the "great men" of his time, and the story is chiefly a history of his career. We are first introduced to him at the age of one year, the opening incident of the story recounting his narrow escape from the maw of a cave hyena, a beast which in those days was large and dangerous and a great contrast in all ways to his modern representative. The father and mother of Ab are carefully described, as well as the cave in which the family live. The cave man's probable daily life (which consisted principally of getting

* Bibliography of Education. By Will S. Monroe. New York: D. Appleton and Company. (International Education Series.) Pp. 202.

† Light Visible and Invisible. A Series of Lectures delivered at the Royal Institution of Great Britain, at Christmas, 1896. New York: The Macmillan Company. Pp. 294. Price, $1.50.

* The Story of Ab. By Stanley Waterloo. Chicago: Way & Williams. Pp. 351. Price, $1.50.

something to eat) is reconstructed, and his weapons, methods of hunting, language, and clothes are discussed. The accident by which the bow and arrow were discovered is graphically related. Methods of capturing large and small game, the variations of different tribes due to varied surroundings, and, in fact, a detailed description of the manners and customs of man in the time of the cave dwellers is worked out with considerable ingenuity and care. The book is evidently the result of a considerable study by Mr. Waterloo of geological ethnology, and will be found very entertaining by all who are at all familiar with geologic history. The psychologist will be entertained by the mentality with which the author has endowed his primitive characters. The book is also rather attractive in appearance, despite its excessively modern binding.

A third edition of Mr. *Albert H. Chester's Catalogue of Minerals Alphabetically Arranged*, and giving their chemical composition and synonyms, is published by John Wiley & Sons. The catalogue has been intended from the beginning to embrace all English names in current use in the nomenclature of mineralogy, including species, varieties, and synonyms, and omitting dead and useless names. In the present edition, which has been revised and entirely reset, all names added up to date have been inserted in their proper order.

Prof. *Clarence Moores Weed* has endeavored, in his *Life Histories of American Insects* (Macmillan Company, $1.50), to present in a nontechnical manner the results of his observations of a few of the most interesting species, some of which he has especially studied during the last ten years; while for other sketches he has drawn upon his fellow entomologists. Among the more curious or more familiar insects thus presented and described are the crickets, walking sticks, grasshoppers, army worm, the insect of raspberry canes, insects that mark apple and oak leaves, wasps, hornets, aphides, and spiders, including "daddy longlegs." The style of the book is attractive, the descriptions are clear, and the illustrations are numerous and excellent.

Professor *Kingsley's Elements of Comparative Zoölogy* is intended as an introduction to the serious study of the subject, and embraces directions for laboratory work upon a selected series of animal types, together with a general account of related forms. By combining the functions of a laboratory guide and a general outline of zoölogy, it has been possible to emphasize the comparative side of the subject. But "it is not sufficient to ask one to compare a grasshopper and a beetle, pointing out their resemblances and points of difference; leading questions must be asked." Such questions are furnished, and when the student has answered them he may be supposed to have "a tolerably complete statement of the principal characters of the larger groups of the animal kingdom." Types have been selected for detailed study, partly with regard to the facility of obtaining them and partly to their adaptability to being worked out by average students, and the work has been made largely macroscopic. Laboratory work is insisted upon as the most important (H. Holt & Co., New York).

Faith or Fact, by *Henry M. Taber*, with preface by Colonel Robert G. Ingersoll (Peter Ecker, publisher, New York, $1), is dedicated to the lovers of mental freedom, and particularly to those who have had to endure opprobrium from orthodox Christianity. It is described in the title-page as "illustrating conflicts between credulity and vitalized thought, superstition and realism, tradition and verity, dogma and reason, bigotry and tolerance, ecclesiastical error and manifest truth, theology and rationalism, miracle and immutable law, pious ignorance and secular intelligence, hypocrisy and sincerity, theocracy and democracy." It is devoted to the criticism of the orthodox branch of Christianity, which the author thinks that system has invited by the course it has pursued in various respects.

Who would have imagined that the problem of the universe could be solved in a book of sixty-five small pages? Great as the task is supposed to be, that is what seems to be attempted by Mr. *John E. Atwood* in his essay on the *Constituents of the Universe* (James Edward Friend, publisher, San Diego, Cal.). The doctrine of the book, which is enlarged upon in various applications, is that "space—extent or room—and time—continuation or motion, are the three great essentials that comprise or constitute the universe";

and that all ideas of anything else existing or acting conveyed by the terms and conceptions which we in the imperfection of our knowledge and capacity have invented to account for the things we see, are false. Mr. Atwood writes as one possessed of strong convictions.

The *Annual Report of the Operations of the United States Life-Saving Service* for the year ending June 30, 1896, presents statistics exhibiting the most satisfactory results yet accomplished by the service. While the total number of disasters was greater than in any prior year, the percentage of lives and property lost was less. The average annual loss of life from 1877, when the service was generally extended to the sea and lake coasts, till June 30, 1896 (excepting the year 1878, when an exceptional mortality attended the disaster to the steamer Metropolis), has been one out of every one hundred and twelve persons on board vessels involved in disaster, and the loss of property twenty-one per cent of the value imperiled.

In his essay on *Value* (Chicago: Rand, McNally & Co., $1) *John Borden* presents a sober discussion of the principles on which value is founded, with its incidents—utility, use, value, relative exchange, market, nature, and money value; to which he adds *A Short Account of American Currency*, giving its history, and a chapter on A National Currency. His exposition of money value is sound, simply expressed, and forcible, showing how there can be but one standard, and that representing the intrinsic value of the bullion contained in the piece, and that coinage is merely a certification that metal to that value is there, not making the value or adding to it. He differs, however, from the majority of the gold-standard men in that he insists that if there is to be paper money (which must be merely representative of actual money behind it), the Government alone should issue it.

The sixth volume of the *Proceedings* of the Davenport Academy of Natural Sciences covers the period from December, 1892, to the beginning of 1897. One of the most emphasized features observed in reading it is that it records the death of so many of the members who took part in the foundation of the academy and contributed to its usefulness and fame. The most important papers contained in the volume are a summary of the archæology of Iowa and a bibliography of Iowa antiquities, by Prof. Frederick Starr; a list of coleoptera from the southern shore of Lake Superior, by Prof. H. F. Wickham; and a revision of the *Trexalinæ* (grasshoppers) of North America, by Prof. Jerome McNeil. Shorter papers of interest relate to local and special subjects. Further, the minutes of the several meetings of the academy and the annual addresses of the presidents are given; also a portrait and biographical sketch of Prof. G. C. Parry, and a bibliography of his works.

The *Eighth Annual Report of the Missouri Botanical Garden* contains papers by William Trelease and J. Cardot, with fine plate illustrations, on the Mosses of the Azores and Madeira and botanical observations on the Azores, embodying the results of the visit of Mr. Trelease to those islands. The belief is expressed that by the system of distribution adopted, papers published in the garden reports are within the reach of more working botanists than those in any other similar publication on this side of the Atlantic. The garden suffered great damage by the tornado of May 27, 1896, and has been at considerable expense in repairing it. Plans are under consideration for making large additions to the grounds. The educational facilities offered by the garden are appreciated and utilized, but not so much as they ought to be.

Ten Noble Poems in English literature is the title of a pamphlet by *J. T. Jones* giving the result of a number of inquiries sent to various prominent literary people. The poems receiving the most votes were as follows: Intimations of Mortality; Saul; Elegy written in a Country Churchyard; Rabbi Ben Ezra; Ode to a Skylark; Harvard Commemoration Ode; The Rime of the Ancient Mariner; Thanatopsis; The Eternal Goodness; Lines on Tintern Abbey (Unity Publishing Company, Chicago).

In *Health of Body and Mind* (Eagle Press, Brookiyn) *T. W. Topham*, M. D., gives us a discussion of the ethics of disease, in which he takes the position advocated by Mr. Spencer—that the care of the body is just as much a duty as is the care of the mind; that

"disease is the result of violated law, a wrong done to Nature, and whether we are responsible for it or not, the fact remains still potent for our consideration of the greatest of all problems, that the sick man is a sinner against Nature, and that he will have to pay the penalty to the last farthing, both for his own and his ancestors' misconduct." Among special chapter headings we find the following: Why We are Sick; The Tension caused by Worry; Athletics; Self-Control; Breathing as a Means of Health; A Plea for the Baby; The Reduction of Fat; and Pain. A number of special exercises are described and pictured.

The Induction Coil in Practical Work, by *Lewis Wright* (Macmillan, $1.25), was written, says the author, simply and solely as a practical help to the efficient and safe use of an induction coil, with some special reference to the revived and extensive use of that apparatus in surgical and physiological work with Röntgen rays. This new field of experiment has brought many into personal contact with coils who have never had any acquaintance with such instruments before, and it is thought that some will like to have a convenient outline of the many other impressive and beautiful experiments in which the induction coil bears a part. There are eight chapters which, starting with a general consideration of electrical induction, go on to a special consideration of the structure of the induction coil, its manipulation and care, the discharges in partial and high vacua, and finally spectrum work and X rays, which seem to cover the ground fairly well in an elementary way. There are numerous diagrams and several well-executed plates.

We have recently received a reprint from the eighth annual report of the Missouri Botanical Garden, entitled *Botanical Observations on the Azores*. Mr. *William Trelease*, the author, seems to have done an immense amount of work in the time which he was able to give his subject—two short leaves of absence in the summers of 1894 and 1896. The volume consists mainly of a catalogue of plants, which is followed by a very instructive series of plates.

The third annual report of the Lake Mohonk Conference on *International Arbitration* consists chiefly of the addresses delivered at the meeting which opened on June 2, 1897. Among the speakers were the Hon. George F. Edmunds, Rev. E. E. Hale, President Dreher, Hon. E. P. Wheeler, Rev. Theodore L. Cuyler, Hon. George F. Seward, Colonel George E. Waring, Jr., Prof. U. P. Gilman, and General James Grant Wilson. The platform adopted by the meeting deplores the failure of the recent treaty between Great Britain and the United States, but rejoices at the rapid popular growth of the arbitration idea, and looks forward to the establishment in the near future of an Arbitration Commission, to which all international disputes shall be submitted.

Students of Hebrew literature and customs will be interested in the pamphlet containing tracts Shekalim and Rosh Hashana of *The Babylonian Talmud*, original text and English translation, with notes and explanations, by *Michael L. Rodkinson*. The notes seem to be ample and satisfactory, and a great relief from the technicalities and obscurities of the text. Published in New York, 54 East 106th Street, by the New Talmud Publishing Company.

Mr. *Maximilian P. E. Grossman's Working System of Child Study for Schools* (Syracuse, N. Y.: C. W. Bardeen, 50 cents) is, as its title indicates, a manual of suggestions as to the method in which the study may be conducted. The author perceives that a systematic method of child study is beginning to be evolved, and shows his appreciation of the matter by declaring that the new pedagogy must be based upon it; but we must not wait until the results of all the researches have been collected, for that would be to wait a long time. There is enough material already on hand for the new education to begin at once. The author has a great advantage in that he is able to present his suggestions in the light of his experience in the New York schools of ethical culture and of the working of the methods pursued there. His precepts are re-enforced by the citation of cases which have been studied there.

"The Philosophy of the Undeniable" is the catching phrase by which Mr. *Dwight H. Olmstead* designates the doctrines contained in a booklet just issued by him (G. P. Putnam's Sons) under the title *The Prot-*

ciant Faith, or Salvation by Belief. It is not, as its title might imply, a devotional treatise, but a series of arguments directed against certain time-worn dogmas still largely held by orthodox churches. Starting out with a summary of the causes of the Lutheran Reformation—"an intellectual rather than a religious movement"—Mr. Olmstead, in a few pages of terse reasoning, demonstrates that the retention of the dogma of justification by faith vitiated the entire Lutheran system, since belief and unbelief are equally involuntary, and therefore neither blameworthy nor deserving of reward. This point, he claims, strikes at the very existence of the churches, and is fatal to their present form and organization. The psychological barrier with which orthodoxy is thus confronted is further strengthened by certain ethical considerations. "Salvation," says the author, "is not a proper incentive to the performance of duty"; and "the theology that looks to the mere salvation of the soul, whether from punishment or from sin itself, can be defended neither on principle nor, paradoxical as it may seem, on the plea of expediency; certainly not, if he be the happiest who is the most virtuous." Thus abandoning these tenets, which in the verbiage of the pulpit are called "essential truths," the author sees in the individual conscience a higher criterion of morality and a nobler guide to salvation, the conscience itself being derived from the aggregate of beliefs entertained for the time being by the individual. Here he recognizes the changeful character of all human thought, and makes provision for further development of religious belief. Although published originally nearly half a century ago, the work is still well abreast of the times, and a newly written introduction on the limitations of thought puts the book in the van of liberal thought. Mr. Olmstead has built up his thesis as if he were constructing a pyramid. His arguments are cemented with a cold and dispassionate logic which goes far to justify his own characterization of his doctrine as the Philosophy of the Undeniable.

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Mexico: Office of the Secretary of Encouragement. Boletin de Agricultura, Mineria, é Industries (Bulletin of Agriculture, Mining, and Industries). For gratuitous distribution. Nos. 1 to 10. 100 to 240 pages each. La Fumagina y el Pulgon de los Cafetos (The Coffee-tree Fungus and Coffee Scale). Pp. 115; El Picudo (*Anthonomus grandis*, Boh.). Pp. 100.

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Asheville, N. C., and Nashville, Tenn., September, 1897. Pp. 104.—Field Columbian Museum, Chicago. Annual Report of the Director to the Board of Trustees for 1896–'97. Pp. 255; List of Fishes and Reptiles obtained by the Expedition to Somaliland in 1896. By S. E. Meek. Pp. 20.—Harvard College. Report of the Director (E. C. Pickering) of the Astronomical Observatory, 1897. Pp. 120.—Illinois Association opposed to the Extension of Suffrage to Women. Pp. 17.—Iowa, State University of. Bulletin from the Laboratories of Natural History. Vol. IV, No. 3. Pp. 122, with 19 plates.—New York Public Library. Astor, Lenox, and Tilden Foundations. Bulletin. December, 1897. Pp. 28.—Wool Manufacturers, National Association of. Quarterly Bulletin. December, 1897. Boston. Pp. 100.—Yale University Observatory. Report of the Board of Managers for 1896–'97. Pp. 23. United States Commissioner of Education. Report for 1895–'96. Vol. II. Pp. 1216.

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Fragments of Science.

School Baths and Workmen's Baths in Germany.—From a long paper on the Public Baths of Europe by Dr. E. M. Hartwell, we take the following: The first public school bath in Germany was placed in a common school in Göttingen in 1883, the mayor of that city being prompted to utilize two basement rooms for the purpose through the suggestion of a professor of hygiene that the provision of well-ventilated schoolrooms was likely to be futile if they were occupied by dirty children. The cost of installation was one hundred and eighty-six dollars. The bath proved an eminent success. The example of Göttingen was followed by other cities, until it is now possible to name some forty German, Swiss, and Scandinavian cities that have introduced warm shower baths into their common schools. Certain cities, as Munich, Berlin, Frankfort, and Cologne, have adopted the policy of placing such baths in all new schoolhouses of the class named. The development and spread of the workman's bath have also been rapid and extensive during the past few years in Germany. It seems that bath houses designed to meet the special needs of operatives were in existence in Mülhausen, in Alsace, early in the fifties. Since that time several more similar baths have been built at Mülhausen. In 1873 the firm of Friedrich Krupp erected a central bath house in its well-known steel works at Essen. The bathrooms are furnished with tubs, hot and cold water, and shower appliances. Free baths are provided in various parts of the Essen works for particular classes of workmen, as furnace men. In the Bessemer works, for instance, there is a bathroom which dates from 1893, containing shower appliances. Dr. Hartwell has compiled a list of nearly two hundred

workmen's baths said to have been established in Germany prior to 1896. In the case of school baths in Germany, the average cost of a warm shower bath is said to be one quarter of a cent, and it is safe to say that, leaving the interest on the plant out of account, the cost in the workmen's baths is about the same, or even less. The cost of the latter baths varies all the way from three hundred and fifty dollars to five thousand dollars—a very good twelve-cabin shower bath, with one hundred and seventy towels and bath caps, having been built at Dalken in the Düsseldorf district for three hundred and forty dollars. Of the great importance of cleanliness in promoting hygienic conditions, it is hardly necessary to speak, and we hope that a similar movement may spring up among the mill owners and large manufacturers in this country. The public schools are also worthy the close attention of our public-school officials.

Explosiveness of Dynamite.—From an article in Industries and Iron, we take the following: In the early days of dynamite the mischievous and often fatal doctrine was thoughtlessly promulgated that under the influence of fire that explosive would only burn, and that nothing would cause it to explode except the application of a proper detonator. Notwithstanding the efforts which have been made to cause the public to unlearn this foolish doctrine, it still lingers. The doctrine preached by those who know anything about the matter is that explosives are only comparatively safe at the best, and then only so long as they are treated as absolutely dangerous. There is no reliance whatever to be placed on the theory that dynamite and many of its congeners can be burned without exploding. This has been illustrated over and over again with fatal results, and the ignorance, crass stupidity, and recklessness occasionally shown by those accustomed to the daily use of high explosives are really incredible. Were the author of a highly flavored story to introduce into his plot the instantaneous death of a newly married couple by an explosion of dynamite in the stove of their sitting room, the explosion being brought about by the bridegroom's brother baking the dynamite in the oven, the author would probably be accused of going beyond the bounds of probability after the sensational, and yet this combination of circumstances did actually occur in a mining district in England. The ingenuity exercised in devising means for thawing dynamite in the most unsafe way possible is certainly very remarkable. This thawing-out process is the most fruitful cause of accidents with dynamite. The dynamite becomes inert at about 40° F., and, while this is a very valuable property for transportation purposes, it plainly also has its disadvantages. To thaw these cartridges tin warming pans constructed on the principle of the glue pot should be provided. This keeps the explosive away from any possible contact with the fire, and prevents the possibility of an excessively high temperature.

Radiography in Medical Practice.—Dr. Francis H. Williams, in an address before the Association of American Physicians, gives an interesting account of his year's work with the X rays, and shows that they must now be accepted as one of the valuable instruments in the general physician's equipment. The varying resistance which the different tissues of the body offer to the passage of the X rays depends upon difference in bulk and chemical composition. The soft tissues of the body contain a large percentage of water, so that they offer about the same resistance as an equal thickness of the latter. The rays, however, pass through air much more readily than they do through water. It is this fact which gives the X ray its special value in physical examinations of the chest. The radiograph of the normal chest shows two clearly marked out lungs, divided by a dark line representing the sternum, and crossed by dark horizontal bands, the ribs. The lower internal portion of the left lung is partially obliterated by the heart, as is also a small segment of the lower portion of the right lung. This picture is normally very sharp and unmistakable, so that any abnormal state of affairs in the lungs and any variation in the size or position of the heart are readily made out by the use of the fluoroscope. In his summary Dr. Williams claims that the X rays, and more especially the fluoroscope, have already proved to be an important addition to the ordinary methods of physical examination, and that

its use is attended with no harmful results to the patient. The complete address, with some interesting illustrations, appeared in the American Journal of the Medical Sciences for December, 1897.

Artesian Wells in Iowa.—The artesian field of Iowa is described by Mr. W. H. Norton as being only a part of an extensive basin which may be termed the artesian area of the upper Mississippi Valley. It includes a part of Missouri, a large part of Illinois, southern Wisconsin, and southern Minnesota. The intake of the whole field lies in the two States last mentioned. The size of the intake area is roughly estimated at about fourteen thousand five hundred square miles. With the whole Iowa field, it lies within a region of abundant rains, enjoying a mean annual rainfall of not less than thirty-two or thirty-three inches. On the basis of De Rance's estimate that one inch of rainfall per year is equivalent to 14,555,280 imperial gallons to the square mile, or a daily average of 40,000 gallons to the mile, the total annual rainfall of the collecting area of the Iowa artesian field may be estimated at about 475,000,000 gallons to the square mile, a daily average of 1,280,000 gallons or a total annual precipitation for the entire collecting area of 6,887,500,000,000 gallons. Only what of this water does not go into the streams and escape by evaporation is available for the artesian reservoir, but there is every reason for believing that that which falls over the collecting area is more than sufficient to meet all the demands made upon it by the Iowa wells.

Submarine Land Slides and Telegraphic Cables.—While the general result of denudation on the land is to bring material to a lower level, and, by gradually wearing away excrescences like mountain heights, to render such forms more stable, beneath the sea, as Prof. John Milne pointed out at the British Association, such materials are accumulated in slopes, which become unstable as the deposits grow, and facial slidings take place from time to time. The movements are caused by gravity, by subterranean springs, and by submarine earthquakes, the effects of which are at least equal to those we see produced on land, and probably greater. These slidings, occurring along the edges of submarine banks and of the submerged continental frontier, are very damaging to telegraphic cables, which are apparently buried under large bodies of material. Sometimes two or three cables, ten or fifteen miles apart, have been destroyed by such slides. Earthquakes have been felt on land at the same moment that a cable has been broken, and the ocean has been thrown into a state of agitation for one or two days. Under very great disturbances of this kind the resultant earth movement might be recorded, with suitable instruments, at any point on the surface of the globe. In the most remarkable disturbances recorded, changes of depth up to two hundred fathoms have taken place over considerable areas. The study of these dislocations should be established on all the continents and oceanic islands.

School Sessions and Health.—In order to obtain a consensus of opinion on the subject, eight questions bearing upon the influence of our school system on the health and development of the child were addressed by Dr. E. Stuver, of Rawlins, Wyoming, to about one hundred and fifty educators and physicians of the country. Twenty-nine out of sixty-three educators and thirty out of thirty-five physicians did not think our present comprehensive course of study best calculated to develop the highest physical and intellectual powers of the child, and some of the respondents condemned these courses severely. Eighteen educators and one physician were doubtful. Respecting the proper length of continuous school sessions, the average of one hundred opinions were in favor of not longer than one hour or an hour and a half. While considerable divergence appeared concerning the limit of length of a single recitation, the majority of respondents advocated from ten to twenty minutes in the primary and from twenty to thirty minutes in the grammar grades; but much was thought to depend upon the nature of the subject of the lesson, the method of instruction, and the kind of teacher. Frequent recesses met much favor, and many respondents advised one every hour. Of one hundred and five opinions expressed as to the relative merits of open-air recesses with spontaneous play and of formal indoor exercises, all except

four were strongly in favor of outdoor exercise, or a combination of calisthenics and the old-fashioned recess. While wide divergence of opinion marked the answers of fifty-three educators and thirty-four physicians concerning the effect of home study, all insisted that the work should be carefully guarded and not carried to extremes, and that the health should be properly looked after at the same time. Some thought it did no more harm than attending parties and keeping late hours socially.

Cereal Foods.—In a recent bulletin of the agricultural experiment station at the University of Wyoming there is an interesting examination into the composition of prepared cereal foods, whose results are summed up as follows: "Leaving aside the customary claims of each food to be the best in the market, and considering only the more specific statements of composition, food value, etc., it may be said that these are in many instances entirely unreliable and misleading as to the real character of the food. . . . If purchasers of goods in packages and cans would always note the brand, and afterward buy according to the quality, it would be an encouragement to honest manufacturers, and the grade of such foods would no doubt be raised. There is more variation in price than in composition, and there is no discoverable relation between quality and price. Some articles are four or five times the cost of others of the same class, and apparently of the same merit. . . . The oatmeal sold in bulk is practically the same in composition and, so far as can be judged by personal taste, in quality and flavor as that sold in packages for several times the price. . . . The claims made for quick cooking are generally fallacious. Almost all such preparations should be cooked for at least half an hour, and usually longer, to insure the complete digestibility of the starch."

Value of Disinterested Science.—The address of President F. M. Webster before the sixth annual meeting of the Association of Economical Entomologists, on The Past and Future of Applied Entomology in America, contains an earnest argument in favor of independent investigation as against work in official bureaus and an emphatic denunciation of attempts to harness science to utility as "the worst of all the ill-matched and mismated combinations possible." The author regrets that the mass of mankind can not seem to comprehend that the naturalist, in order to secure results of value, "must work out his problems in a natural way, and not as a part of a machine, and that this condition is universal and one which no power on earth can change." In illustration of the value of international work in entomology, the author refers to the monetary value of the benefits this country has derived from the work of two entomologists who were sent several years ago to Australia, one of whom at least "has been able to serve his country and State better since his return," and adds that an American expert is now the official entomologist of Cape Colony, South Africa, and another is in the Argentine Republic, engaged in the investigation of some injurious insects in that country. The author sees that public opinion regarding the entomologists and their work has been changing for the better; but if this change is to continue they must do better work, the results of which will be far reaching and permanent. "The 'powers that be' over and among us must be brought to understand that science is truth and not something that is to be trifled with and debauched, or made to answer for cheap advertisements, or used for the purpose of paying political indebtedness."

Flora of the Sandwich Islands.—Isolated from a continental area, and almost equally so from the other islands of the Polynesian system, says Mr. A. A. Heller, in Minnesota Botanical Studies, Hawaiian vegetation has developed independent of extraneous modifying conditions. That it has done so in a satisfactory way is evinced in the enumeration in Hillebrand's *Flora* of 999 species of phanerogams and vascular cryptogams, of which 139 are introduced and 653 are endemic, leaving 297 species found elsewhere. Of the 653 endemic species, 250 belong to 40 endemic genera; and these are found principally among the *Rubiaceæ*, *Compositæ*, *Lobeliaceæ*, and *Labiatæ*. Besides these larger genera, there are smaller ones which have representation only on the northern islands. The great number of ferns appeal to the eye of the botanist. Omitting

the lower cryptogams, they comprise one sixth of the native vegetation. The comparative scarcity of grasses and of composite and leguminous plants, as contrasted with the unusually large number of *Rutaceæ*, *Rubiaceæ*, *Lobeliaceæ*, and *Labiatæ*, is a matter of astonishment to the collector from more temperate regions. To the student of the lower cryptogams an immense field is open. Near the summits of the mountains, and in other places where there is a large amount of moisture, the trees, bushes, and ground are draped and carpeted with mosses and liverworts. Lichens seem to be most abundant on the trees and rocks of the lower and middle regions. The "kukui" tree, which flourishes only in the lower forest region, is the host of more species of lichen than perhaps any other tree. Next comes the "koa" tree, which harbors many interesting species, but, as a rule, different from those which are found on the kukui tree. Parasitic fungi are common on the leaves and stalks of many plants, but fleshy fungi seem to be scarce. Marine algæ are abundant.

Trades Unions in China.—The following facts regarding trades unions in China are taken from an abstract of Consul Charles's report in the Journal of the Society of Arts. Although labor is cheap in China, the workmen seem able to dictate their own terms. Neither masons nor carpenters begin work in winter much before 9 A. M.; in summer they knock off at noon for a long two hours' *siesta*, and at all seasons of the year smoke and drink tea, and rest whenever it suits them. According to the regulations of the builders' union, wages, if the men find their own food, are one hundred and eighty *cash* (about twelve cents) a day. These, in the case of skilled laborers, include their apprentices' wages, which are paid at the same rate. As accidents are frequent in the trade, especially among unskilled hands, the parent of the apprentice has to give an engagement in writing holding the boy's master free from all liability, but a present is expected in case of an accident. No interference is permitted with a customer's engaging any builder preferred by him. No outside firm is allowed to work, however, until it has joined the union and received a certificate, the fee for which varies. Masters have to pay the union at the rate of about one tenth of a cent per diem for every man employed by them, to form a fund to meet subscriptions. A similar tax is levied on assistants to meet the cost of festivals, illuminations, etc. If trouble occurs between a builder and his employees and work is stopped, no other labor can be engaged in until all outstanding accounts are settled. Attendance is obligatory at meetings called to fix the quota to be paid toward subscription funds. There are but five important guilds or trade unions in China — the silk and piece goods, the banks, the sugar, the rice, and the general dealers. The members of these guilds are taxed in proportion to their business to meet the various subscriptions required from the guilds toward canal works, etc. The funds are also used for the relief of widows and orphans of former members. The whole power of trade in China rests in combination and monopoly.

Rhodesia.—Mr. F. C. Selous, who has spent twenty-five years in the country north and south of the Zambesi—in Matabeleland and Zululand—gave the British Association a favorable account of the climate of Rhodesia, and the adaptability of the highland country to white settlement. He regarded the climate as singularly favorable for the development of Europeans. He had never seen a finer race of men than the Boers and the British colonists of English, Irish, and Scotch descent, who were established in Cape Colony in 1820. They are tall, fine men, and the speaker believed that the highlands of Rhodesia would produce an equally fine race. The country includes the valleys of the Zambesi and Limpopo, where as in all African lowlands, deadly malaria prevails; and it is only the tracts four thousand feet and more above the sea level—in the elevated backbone of the country, which forms the watershed between the Zambesi and the Limpopo in the west, and the Zambesi and the Sabi in the east—that can be looked upon as likely to become peopled by white men. Possibly, as settlement advances, cultivation may gradually encroach upon the lower regions and drive the malaria from them. The superficial area of that part of Rhodesia which lies at and above an

elevation of four thousand feet extends approximately over an area of twenty-six thousand five hundred square miles, while another seventy-two thousand five hundred square miles may be added which lie between three thousand and four thousand feet. The country has suffered much of recent years, with all South Africa, from rinderpest, locusts, and drought, but more favorable conditions are hoped for, and with them anything can be grown that can be grown in Cape Colony. Wheat and oats, however, will have to be raised in the dry season with irrigation. For markets the farmer must look to the local towns, and their growth will depend upon the development of the gold prospects; and a wider market awaits the stock farmer. Matabeleland has been demonstrated to be a good cattle country. The natives formerly possessed considerable herds of sheep and goats, but these were killed and eaten during the scarcity of food. Sheep, however, seem to thrive well, as do pigs and donkeys. Well-bred fowls are subject to much disease, and the native birds are very small and lay small eggs. Horses do badly in all parts of Rhodesia. The speaker did not look upon the land as a ready-made paradise. Such a spot is hardly to be found in the unoccupied world; but "the earthly paradise of a happy home in a wild land must be created by a man's own labor, patience, intelligence, and perseverance."

Liquefied Fluorine.—The much-sought-for alkahest, or universal solvent of the ancient alchemists, is almost realized in fluorine, which was first prepared by Moissan in 1886. The transparent vessels in which it is contained have to be made of some fluoride, its action on ordinary glass being vigorous and destructive. The difficulty of handling the gas, even in the laboratory, has hence been very great, the fluoride vessels being brittle and clumsy as well as expensive. Professors Dewar and Moissan, being desirous of more fully investigating the properties of the gas, recently conducted a series of experiments at the Royal Institution, in which by means of liquid oxygen they succeeded in liquefying fluorine, and in this comparatively inert state could more fully and carefully examine its properties. The apparatus used for liquefying the gas consisted of a small cylinder of thin glass, into the upper part of which was fused a platinum tube surrounding a smaller tube of the same material. The fluorine enters through the larger tube, passes around the glass envelope, and escapes through the smaller tube. The glass cylinder being cooled down to the temperature of boiling liquid oxygen (— 183°), the current of fluorine gas was passed through the bulb without becoming liquid; at this low temperature, however, the fluorine did not attack the glass. On still further lowering the temperature of the liquid oxygen, by exhaustion, a yellow liquid was seen collecting in the glass envelope, while gas no longer escaped from the apparatus. At this moment the escape tube was closed to prevent the entrance of air, and the glass bulb soon became full of a clear yellow liquid possessed of great mobility. Fluorine thus liquefies at about — 185°. The chemical activity of the gas was found greatly reduced when in the liquid state, but even then benzene or oil of turpentine underwent spontaneous decomposition when brought into contact with it. It would thus seem that the powerful affinity of fluorine for hydrogen is the last to disappear. In a subsequent experiment, in which liquid air was used and a temperature approximating — 210° obtained, the liquid fluorine showed no signs of solidification. Experiments to determine its density led to the conclusion that it had about the same specific gravity as amber, 1·14. Different samples of the liquid examined with the spectroscope showed no specific absorption bands in the visible spectrum. It was found to be not magnetic.

Monazite.—Much has been said of late years, in discussions concerning the "rare earths" and the search in them for new metals, about monazite; and the mineral has obtained considerable commercial importance in consequence of its use in the manufacture of the incandescent mantles of the Welsbach light. Monazite, as described by H. B. C. Nitze in the Franklin Institute, is essentially a phosphate of the rare earth metals cerium, lanthanum, and didymium. It also usually contains small variable percentages of thoria in the form of thorite or orangite—a derivative of another rare metal, thorium. It

crystallizes in the monoclinic system, in tubular or short columnar or needle-shaped crystals, usually well developed and free from distortion, varying from microscopic size to five inches in length. It is brittle, transparent in the purest crystals, and of shades of yellow or brown in color. It is an accessory constituent of the granite rocks and their derived gneisses, and has been found in apatite, cyanite, and veined quartz, but not in sedimentary rocks. The economically valuable deposits are found in the placer sands of streams and rivers, in the irregular sedimentary sand deposits of old stream beds and bottoms, now covered up, and in the beach-sand deposits of certain seashores. Workable deposits of monazite have so far been found only in limited geographical areas. The only ones in the United States are the placer beds in North and South Carolina; in Burke, McDowell, Rutherford, Cleveland, and Polk Counties, North Carolina, and in Spartanburg, Greenville, and York Counties, South Carolina. They occur in gravel deposits, from one to two feet thick, in streams that are seldom more than twelve feet wide. Other deposits are found in Brazil, the United States of Colombia, and Russia. The value of monazite depends on its percentage of thoria, the earth sought after by the Welsbach-light men. The Carolina beds furnished one million nine hundred thousand pounds of monazite in 1896, at from six to ten cents a pound. The next year the output fell off, both in amount and price, on account of the competition of the Brazilian field, where the production is easier and cheaper.

MINOR PARAGRAPHS.

Institute of France, Cuvier Prize.—At the session of the *Académie des Sciences* held at Paris, December 13, 1897, the Cuvier Prize of 1,500 francs was awarded to Professor O. C. Marsh, of Yale University. This prize is "awarded every three years for the most remarkable work either on the Animal Kingdom or on Geology."

The Cuvier Prize is generally regarded as the highest honor in natural science, and hitherto has been given to only two persons in this country, Agassiz and Leidy. The former, however, was a native of Switzerland, and there the special work was done for which his prize was awarded.

THE vine was once much more largely cultivated in England than it is now, and English wines were not unknown. The recent success of Lord Bute's vineyards at Castle Cook, near Cardiff, Wales, seems to favor the prospect that the grape and its products may yet, if the people take to it, win a position of importance among British industries. The vines were planted in 1875. The yield of wine has, with various fluctuations, risen from forty gallons in 1877 to forty hogsheads in 1893 and 1896; and the cost of all previous experiments was covered by the crop of 1893. That this success is not merely an accident of locality is proved by the return of a second vineyard, which was planted in another part of Lord Bute's estate, the vines of which are thoroughly established, grow vigorously, and ripen well in most years. "We are planting thousands of vines every year, and propose to plant an acre every spring. Six hogsheads of wine were given in 1895 by the one acre in bearing condition in the new vineyard, in a season when many of the grapes and fruit and vine crops were spoiled by mildew."

CONCERNING the useful aspect of earthquake observations, Prof. John Milne said, in the British Association, that in Japan it is now clearly recognized that ordinary engineering practice as applied to embankments, piers for bridges, tall chimneys, the framing of ordinary dwellings, and other structures is to be avoided; and whenever, as, for example, after a disastrous earthquake or a fire, reconstruction is required, new methods are adopted, and the loss of life and property is being steadily reduced. The application of seismometry to measuring the irregular movements of locomotives has resulted in new forms of balancing the engines, with, among other incidents, a marked saving of fuel. By the use of seismographs along the coast of Japan submerged areas of seismic activity have been mapped through which it would be dangerous to lay a cable. Instruments which record the unfelt movements of the earth's crust sometimes tell us that cable interruption is due to earthquake action

so far from land that it can not be felt by those on shore. These instruments, wherever they are established, give information of great seismic disturbances, even when they take place at the antipodes of the place of observation. Hence they enable us to correct, confirm, and even to disprove telegraphic information.

THE peach is cultivated in Belgium grafted or budded on the red plum, which imparts much of its superior vitality to the scion. The proper calcareous quality is imparted to the soil by manuring thoroughly and applying about a bushel of lime to each tree. The trees are trained upon the sunny sides of the houses, and few houses are without trees covering their walls. To shelter the buds at the time of flowering branches cut from other green trees are placed among the upper boughs, or they are covered with mosquito netting or other material with meshes large enough to give passage to light and air; or simply devised shelters of straw are laid over them. The shields are usually placed in position about the 1st of March, and are not removed, except in cloudy weather, till all danger from frost has passed.

AMONG the curiosities of architecture described by Mr. F. T. Hodgson in Architecture and Building we find the following: "The Exchange building in the city of Copenhagen has attached to it a tower and spire that is one of the sights of Denmark's capital. It is one of the most remarkable examples of eccentric architecture known, although the architect in his desire for originality has not sacrificed grace of form. The lower part is octagonal in shape; but the upper part consists of four carved dragons whose tails, gracefully entwined, gradually taper away and form the spire of the Exchange. The tower and spire run up over one hundred and sixty-five feet, and the tails of the dragons are 'scaled' or imbricated, and the effect is rather pleasing. The Exchange was built in 1815."

PROF. E. RAY LANKESTER has taken the pains to contradict an assertion that he was opposed to amateurs in science. "There is not a particle of truth in it," he writes; "the members of the Marine Biological Association are mostly 'amateurs'; Darwin was an amateur; it is rare indeed to find a professional naturalist of any merit who is not in the true sense of the term an amateur. I desire no better term to describe my relation to biological science than that of 'amateur.' My students in London and in Oxford who have been good for anything in the making of new knowledge have been 'amateurs,' and the whole body of men who have co-operated with me for thirty years in the production of the Quarterly Journal of Microscopical Science have been, with very rare exceptions, 'amateurs.' It is, consequently, obvious that I have never despised the efforts of amateurs on the ground that they were made by amateurs; but, on the contrary, have been occupied entirely with organizing those efforts, and in making and recording observations myself as an amateur. On the other hand, I have but little toleration for incompetence, pretense, or fraud, whether in an amateur or a professional man."

NOTES.

ONE will be impressed with the importance of good roads, Mr. John Gifford reports to the Geological Survey of New Jersey, by a visit to the forest region of Germany, where forest exploitation and road construction go hand in hand, so that inaccessible forest regions become profitable solely through the construction of excellent roads. In Germany such roads penetrate the forests in almost every direction. In certain parts of France, where a few grapevine twigs a day must serve a family for fuel, inconvenience and sometimes suffering are incurred for the lack of wood, while not far away, on the shores of the Bay of Biscay, immense quantities of excellent wood are allowed to rot, simply because a lack of roads makes the transportation of the wood unprofitable.

IT is stated in a recent copy of the London Lancet that Professor Sanarelli has succeeded in obtaining an active immunizing serum against yellow fever. He has at present in his laboratory three dogs and two horses, well "vaccinated," which have yielded serums giving perfect immunization against experimental yellow fever in animals.

THE results of the experiments of Mr. Bokorney upon the relative antiseptic action of various substances give silver nitrate and mercuric chloride as the most effective of the inorganic compounds examined, and as having about the same value. Copper sulphate is nearly as active, and is followed by zinc sulphate and cadmium sulphate. Lead acetate and nitrate, in a one-per-cent solu-

tion, only delay decay, while it is prevented by the same strength of iron sulphide. The fluorides are not strong antiseptics.

THE working of a plan of ventilation of rooms devised by Dr. Castaing, principal physician of the French armies, was very highly spoken of by Dr. Vallin in the Academy of Sciences. It consists in having double windows, with an opening at the bottom of one of the screens and at the top of the opposite one. The air comes in freely without any one feeling it. Professor Potain spoke of the system as being excellent, on account of its simplicity, efficiency, and cheapness.

IN a circular issued from the New York Agricultural Experiment Station at Geneva, Mr. W. H. Jordan, the director, declares that the station has no connection with a scheme for establishing creameries, in the prospectuses of which its name is used, and that it does not countenance the scheme, but regards it as a fraud.

WHILE formerly the quality of water as to purity was thought to be a matter of chemistry and determinable by chemical analysis, the whole tendency of modern research has been, as Dr. A. H. Veeder has shown in a paper read before the American Microscopical Society, to cause the question of the spread of disease through the agency of water to be regarded as rather a biological one. The danger is determined by the presence of certain living organisms and of the conditions on which their continued existence depends, and not upon the quantity of them. The smallest possible inoculation may be fatal through their power of self-propagation, and there is no fixed dose. But if their growth is hindered by unfavorable conditions, they may become harmless, no matter how many of them there may be. The purification of water depends on the destruction of these organisms, or the production of conditions unfavorable to their growth.

AN unusually unpromising lot of candidates seem to have presented themselves before the Massachusetts Board of Pharmacy for certificates during the past year. There were five hundred and forty candidates, of whom only seventy-nine were passed. Of these seventy-nine, fourteen passed on the first examination, nineteen on the second, seven on the third, seventeen on the fourth, seven on the fifth, five on the sixth, and so on up to the eighteenth examition, at which the last of the seventy-nine was admitted.

THE United States Geological Survey announces in its List of Publications that, except in those cases where an extra number of any special memoir or report has been supplied by order of Congress or by the Secretary of the Interior, it has no copies of its publications for gratuitous distribution. Applicants for publications should give their reasons for desiring them, and the indorsement of a member of Congress is advised in all cases. Special attention is given to the requests of libraries, schools, colleges, scientific museums, associations, and societies, but they should supply full information respecting themselves. Special publications and memoirs may be secured by exchange for books that are likely to be a desirable addition to the Survey library. Publications purchased should be ordered by members, with prepayment by postal or express order—not by postage stamps, checks, or drafts.

M. RAOUL, a pharmacist of the French Marine, has just returned from Malaysia, whither he was dispatched to secure useful plants for cultivation in the French colonies, with fine collections of new textile plants, India-rubber and gutta-percha trees, and trees bearing fats, resins, and gums. He found in the interior of Sumatra gold, petroleum, and rich forests of trees of economical value. Members of the party who were bitten by serpents were cured by injections of a serum prepared by Dr. Calmette, director of the bacteriological institute of the island.

M. A. JOLY, professor of chemistry in Paris, died in December, 1897, in his fifty-second year. His principal chemical researches were made upon niobium and other rare metals, the acids of phosphorus, and hydrocyanic acid.

THE Hon. Gardiner Greene Hubbard, president of the National Geographic Society and one of the founders of Science, died near Washington, December 11, 1897, in his seventy-sixth year.

WE have to record the deaths, during the month, of Alonzo S. Kimball, since 1872 professor of physics at Worcester Polytechnic Institute, Massachusetts, December 2d, aged fifty-four years; Dr. Louis Calori, professor of anatomy in the University of Bologna, author of papers on Human and Comparative Anatomy; Dr. Wilhelm Blomstrand, professor of chemistry in the University of Lund; Dr. Nikolaus Kleinenberg, professor of comparative anatomy in the University of Palermo; Dr. Wilhelm Moericke, docent in geology at the University of Freiburg; James Bateman, botanist and horticulturist, promoter of botanical expeditions and author of Orchidaceæ of Mexico and Guatemala, and of a monograph of Odontoglossum, at Worthing, England, November 27th, aged eighty-six years; Dr. Campbell Morfitt, formerly professor of applied chemistry in the University of Maryland, in London, December 5th, aged seventy-five years; and of Dr. Ernest Hart, an active and eminent British sanitarian, editor of the Sanitary Record and the London Medical Record, formerly co-editor of the Lancet, and a contributor to the Popular Science Monthly, in his sixty-second year.